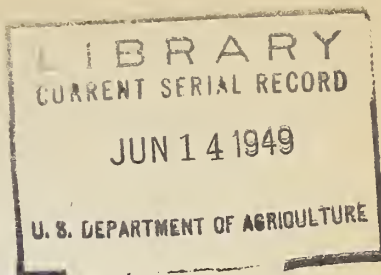


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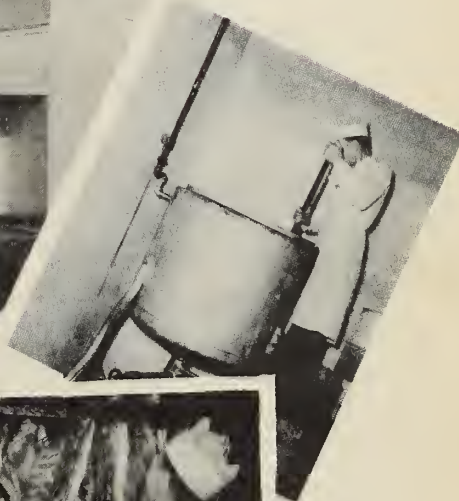
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PROCESSING *by Frozen Food Locker Cooperatives*



A STUDY CONDUCTED WITH FUNDS PROVIDED BY THE RESEARCH AND MARKETING ACT



BY
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COOPERATIVE RESEARCH AND SERVICE DIVISION
FARM CREDIT ADMINISTRATION
U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

MISCELLANEOUS REPORT 129

MARCH 1949

INV. '60

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM CREDIT ADMINISTRATION
WASHINGTON 25, D. C.
I. W. DUGGAN, GOVERNOR

COOPERATIVE RESEARCH AND SERVICE DIVISION

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CONTENTS

	<u>Page</u>
Summary	
Scope and purpose of survey-----	2
Slaughter facilities used-----	3
Plant equipment-----	6
Source of livestock slaughtered-----	9
Livestock and poultry slaughtered and processed-----	10
Rates and charges-----	14
Slaughtering and processing techniques-----	18
By-product utilization-----	30
Sanitation-----	33
Employees needed-----	34
Receipts, expenses, and net savings-----	35
Conclusions and suggestions-----	40
Appendix-----	46

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SUMMARY

1. Seventy associations operating 65 slaughter and 112 locker plants located in 9 Midwestern, Southwestern, and Southeastern States furnished information for the study.

2. Investment in facilities averaged \$66,288 per association; or \$75 per locker. Slaughter facilities represented on the average about 30 percent of total investment.

3. Volume of livestock slaughtered annually by 25 associations totaled 41,315 head of which 56 percent were hogs and 44 percent cattle and calves. Associations averaged 900 hogs and 700 cattle although 70 percent of them slaughtered less than 600 cattle and 50 percent of them less than 600 hogs per year.

Volume of meat and poultry processed averaged 388 pounds per locker rented and ranged from an average of 309 pounds in Virginia to 678 pounds in Minnesota.

4. Rates for slaughtering cattle averaged \$4.24 per head and ranged from \$2.39 to \$7.37. The higher rates were in the South and East where a large number of the associations kept the hide for slaughtering. Average charge for slaughtering hogs was \$2.46 per head and ranged from \$2.00 in Midwest to \$3.30 in Southern and Eastern States.

Rates for cutting, wrapping, freezing, and grinding averaged \$2.69 per hundred pounds and ranged from \$2.07 to \$3.78.

Locker rental rates averaged \$13.19 per locker and ranged from \$10.73 to \$14.91 per locker. Lowest rates were in the Midwest and highest in the South and East.

5. Slaughtering methods were quite similar. Except for a few large plants, most of the work was accomplished by hand labor.

Processing methods also were quite uniform, with the exception of curing and smoking. The practice of pumping with curing pickle in combination with dry cure was most common in Midwestern plants, while the straight dry cure method was most generally followed in Southern plants.

6. Cooperative locker plants did very little processing of either edible or inedible by-products and most plants sold hides green or uncured.

7. The most usual number of full-time employees needed to operate a locker plant with slaughter facilities was reported to be 2 to 3 persons for a 300 to 499 size locker plant; 3 to 4 for a plant with 500 to 799 lockers; and with 800 to 1100 lockers, 4 to 7 employees.

8. Gross annual receipts per locker rented averaged \$38.38; expenses before income tax and interest, \$34.35; and net savings, \$4.03.

Locker rentals represented 38.8 percent of gross receipts; slaughtering, 6.9 percent; other processing, 39 percent; inedible sales, 9.6 percent; and other receipts, 5.7 percent.

Expenses averaged \$34.35 per locker rented and represented 89.5 percent of gross receipts. Labor cost represented 50 percent of total expenses; utilities, 9 percent; fixed charges, 17 percent; and other expenses, 24 percent.

Return on investment averaged 5 percent for all associations. Approximately 38 percent of the associations operated at a loss or had returns of less than 5 percent, while 28 percent of the associations had between 5 and 10 percent, and 34 percent of them realized returns of more than 10 percent.

9. The efficient use of labor is one of the most important factors influencing profitable operations. On the average, 98 cents was spent for labor and management for each dollar of processing income. This average cost ranged from less than 80 cents in Minnesota to \$1.10 in Virginia.

PROCESSING BY FROZEN FOOD LOCKER COOPERATIVES

By

L. B. Mann, R. L. Fox, and P. C. Wilkins

Agricultural Economists

The frozen food locker industry, during the past 10 years, has had a remarkable growth and today plays an important part in food preservation. With less than 1,300 plants in 1938, the industry has grown until in July 1948 more than 10,600 locker plants were in operation. The importance of the industry is indicated by the volume of food processed, the number of people served, and the amount of money invested. Estimates based on a survey made in July 1948¹ indicate these locker plants had a capacity of 5 1/2 million locker boxes capable of processing and storing approximately 1.8 billion pounds of food for over 4 1/2 million patrons, nearly 75 percent of whom were farmers. Total estimated investment in plant facilities was over \$300 million with annual gross income of about \$150 million.

About 10 percent of all locker plants are cooperatively owned and operated. Total investment in these plants is estimated at \$25 million with annual gross receipts of about \$13 million.

In the early days of locker plant operation, services were limited largely to chilling, aging, cutting, wrapping, freezing, and storing meats, poultry, fruits, and vegetables. The conditions, however, have changed in the past few years. To successfully meet increased operating costs, keener competition, and increased demand for better service, it has become necessary for locker operators to improve and expand their services, to reduce wastes, utilize labor more efficiently, and to expand their operations not only to serve locker patrons but also home unit owners, restaurants, retail stores, and institutions.

The development of processing services has been one of the most important factors contributing to the rapid growth of locker plants. The modern locker plant developed when locker storage service was combined with preparing the product for storage.

Patrons' demand for processing services resulted in a rapid increase in both the number and variety of services offered by locker plants. A survey in 1947 of locker cooperatives revealed that cutting, wrapping, freezing, and grinding services were provided by 86 percent of the associations; slaughtering service, 43 percent; curing, 50 percent; lard rendering, 41 percent; and poultry killing, 28 percent. Many associations provide additional minor services to round out their processing operations.

¹Warner, K. F. Frozen Food Locker Plants in the United States, eleventh annual count, July 1948. U. S. Department of Agriculture, Extension Service, 1 p., mimeographed.

NOTE: The authors express appreciation to C. G. Randell for assistance in preparing schedules, to H. H. Hulbert for gathering field data, and to Jane H. Click for assistance in preparing the tables. Credit is also due R. C. Ashby and W. J. Wills of the University of Illinois and D. C. Dvoracek of the University of Minnesota for their assistance in obtaining field data in these States.

The growth of the industry and the expansion of processing operations created a demand for information on proper and efficient processing facilities and techniques.

A locker plant is confronted with problems peculiar to several kinds of business enterprises. For instance, the locker plant acts in the capacity of a processor of a variety of food products. Likewise, the locker plant performs a retailing and wholesaling service. In addition, the locker plant also serves as a warehouse for the storage of patrons' processed products.

Little information is available on the size and type of slaughter plant best suited for locker plant operation. Also, many operators do not recognize the importance of proper slaughtering methods and sanitary facilities. The wide variations in curing and smoking methods, the nonuniformity of products, as well as the high percentage of loss in some plants stresses the importance for more research and greater dissemination of information on this subject. Information is needed on methods of preparing commercial type sausage and specialty meat products that can be manufactured in locker plants as well as on poultry dressing and processing methods. Types of equipment suited to small volume operation need to be developed to utilize labor more efficiently and to produce high quality products. Better ways of using inedible by-products also need more attention and research.

In addition, there is a need for better accounting and operating procedures, and more intelligent public relations, promotional, and educational programs, if locker plants are to earn their way in competition with other food handling services.

SCOPE AND PURPOSE OF SURVEY

This study is designed to provide managers, directors of locker associations, and others with information on processing facilities and techniques in general use in the industry. More specifically, it provides information on type and size of facilities, equipment used, livestock procurement, volume slaughtered and processed, rates and charges, techniques used in slaughtering and processing, utilization of edible and inedible offal, and operating results. This study discusses meat and poultry as these products account for nearly all the volume processed. While limited amounts of fruit and vegetables are frozen and stored in lockers, most of the processing is done by patrons at home. The main body of the report covers largely a description of facilities, equipment, and operating methods of plants surveyed with but little comment upon favorable or unsatisfactory plant layouts or operating techniques. Criticisms and recommendations for improvement are contained in the chapter on Conclusions and Suggestions.

Information was obtained from managers through personal interviews. Seventy associations operating 112 locker plants with a total capacity of 55,700 lockers were visited during the fall, winter, and spring of

1947-48. Of these 70 associations 65 had slaughter facilities, 3 of which were in the final stages of construction. These 65 associations operated 100 locker plants with a total of 49,125 lockers.

The associations included in this study were located in 4 areas - the Corn Belt, Northern Plains, Southwest, and Southeast. States covered by the survey were Illinois, Minnesota, North Dakota, Texas, Oklahoma, Louisiana, Mississippi, Virginia, and Maryland (see table 1).

PLANTS OPERATED PER ASSOCIATION

Nearly 73 percent of the associations surveyed operated only one plant; 10 percent, 2 plants; 6 percent, 3 plants; 9 percent, 4 plants; 1 percent, 5 plants; and 1 percent, 6 plants (table 2).

Associations operating more than one plant were located largely in Illinois and Texas. In Illinois, where a majority of associations operate more than one plant, a recent trend has been toward concentrating slaughtering and processing operations in one plant which serves a number of branches within a county.

SLAUGHTER FACILITIES USED

The types and sizes of slaughter facilities varied widely from very simple, inexpensive buildings and equipment costing as little as \$2,000 to modern, fully equipped, centralized slaughtering, processing, and freezing plants costing as much as \$100,000. The majority of the slaughter plants cost less than \$25,000. Size of slaughter rooms ranged from 120 square feet to over 1,600 square feet. Nearly 50 percent of these slaughter rooms ranged between 200 and 400 square feet in floor space, and 20 percent were between 400 and 600 square feet, with only 10 percent over 1,000 square feet. Floor plans and equipment layouts of several different types of slaughter plants are presented in the appendix.

Table 1. - Associations with slaughter facilities, number locker plants operated, and total number of lockers installed, by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED	LOCKER PLANTS OPERATED	TOTAL NUMBER OF LOCKERS
Illinois-----	16	38	19,164
Minnesota-----	14	15	7,721
North Dakota-----	5	5	2,318
Texas-----	14	19	8,916
Oklahoma-----	1	2	800
Louisiana-----	2	2	700
Mississippi-----	3	3	1,462
Virginia-----	9	13	6,559
Maryland-----	1	3	1,485
Total-----	65	100	49,125

Table 2. - Plants operated by each association, 1947-48.

PLANTS OPERATED PER ASSOCIATION	NUMBER OF ASSOCIATIONS
1-----	51
2-----	7
3-----	4
4-----	6
5-----	1
6-----	1
Total-----	70

Of the 65 associations reporting, 49 had slaughter rooms in the same building with the locker plant, and 16 were separated. Of these 16 plants, 10 had chill rooms at the slaughter plant, and 6 did not.

INVESTMENT IN FACILITIES

Information obtained from 51 associations operating slaughter plants showed a total investment of \$3,380,692. The average was \$66,288 per association or \$75 per locker as shown in table 3. As more than 75 per cent of the slaughter facilities were built as a part of the locker plant, it was not possible to determine the cost of the slaughter facility except in a few associations. Average cost per locker varied from a low of \$52 in Minnesota to over \$100 in the Southeastern States (table 3). Extreme ranges of from \$32 to \$168 per locker were reported for individual plants. Some of these differences were due to the time of plant construction, to types and variety of services offered, size of plants, and type of construction. Much of the difference, however, appeared to be due to areas in which plants were located.

Investment in locker-slaughter facilities of five plants built in Louisiana and Mississippi ranged from \$80 to \$118 per locker and averaged \$101 for the area. Ten Virginia and Maryland plants cost from \$64 to \$165 per locker and averaged \$103, while 12 Texas and Oklahoma plants



The central slaughtering and processing plant operated by Macoupin County Locker Service, Carlinville, Illinois, serves 5 branches with 3500 lockers.



Locker plant with slaughter facilities operated by Valley Mills Refrigeration Cooperative, Inc., Valley Mills, Texas.

ranged from \$50 to \$168 and averaged \$76 per locker. The majority of plants in these States were built from 1945 to 1947. Thirteen Illinois plants ranged in cost from \$40 to \$84 per locker, and averaged \$67 per locker, while 8 Minnesota plants cost from \$42 to \$83 and averaged \$52 per locker. While a number of these plants were built as early as 1938 most of them were constructed or expanded during the past 4 to 5 years. Three plants in North Dakota, built from 1942 to 1945, ranged from \$49 to \$69 and averaged \$59 per locker.

In general, the plants offering the most complete service such as slaughtering, chilling, aging, cutting, wrapping, freezing, curing, smoking, lard rendering, and poultry dressing had the largest investment in facilities. It also was apparent that the plants constructed in 1947 and 1948 were much more costly than those built earlier. Plants in the South and East, built mostly since the war, averaged higher in cost than those in the Midwest.

Table 3. - Average investment in fixed assets per locker capacity, by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED	INVESTMENT PER LOCKER
Illinois-----	13	\$67.07
Minnesota-----	8	52.38
North Dakota-----	3	59.04
Texas and Oklahoma-----	12	75.98
Louisiana and Mississippi--	5	101.21
Virginia and Maryland-----	10	102.74
Total and average-----	¹ 51	75.09

¹These 51 associations operate 51 slaughter plants serving 82 locker plants.

Investment data from 10 associations operating slaughter plants in Illinois and Virginia, showed the cost of slaughter facilities alone averaged \$19.37 per locker. It represented approximately 27 percent of the combined cost of locker and slaughter facilities or, in other words, increased investment in locker facilities by 38 percent (table 4).

PLANT EQUIPMENT

Major slaughter equipment ranged from hand hoists and no vats for scalding hogs to facilities quite comparable to those of small commercial packing plants - electric hoists, scalding vats, dehairing machines, etc. Table 5 indicates the extent to which plants used various types of equipment.



A completely equipped slaughter room in a centralized type slaughter-processing plant in the Midwest.

Table 4. - Investment in slaughter facilities by 10 locker associations in Illinois and Virginia.

ASSOCIATION	SERVICES RENDERED ¹	NUMBER OF LOCKER PLANTS SERVED	CAPACITY OF LOCKER PLANTS SERVED	YEAR BUILT	COST OF SLAUGHTER FACILITY	COST PER LOCKER
			<i>Lockers</i>			
A-----	SL, CH, C.W.F.G., C&S, RL, DP.	5	3,468	1947	\$105,467.59	\$30.15
B-----	SL, CH, C&S, RL, DP.	2	1,819	1948	46,611.17	25.62
C-----	SL, CH, RL, DP.	3	1,843	1947	56,160.43	30.47
D-----	SL, CH, DP.	1	1,059	1947	27,013.13	25.51
E-----	SL, CH, DP.	4	3,580	1944	16,330.97	4.56
F-----	SL, CH.	4	2,508	1946	51,500.00	20.54
G-----	SL, CH.	4	1,697	1945	² 9,766.15	5.75
H-----	SL, CH, DP.	1	488	1948	17,846.71	36.57
I-----	SL.	3	1,116	1944	4,538.69	4.07
J-----	SL.	1	402	1948	6,000.00	14.92
Total and average		28	17,980	-	\$341,234.84	\$19.37

¹Type of service: SL - Slaughter
 CH - Chill
 C.W.F.G. - Cut, wrap, freeze, and grind
 C&S - Cure and smoke
 RL - Render lard
 DP - Dress poultry

²Installed in remodeled building.

Table 5. - Equipment used in slaughter rooms of frozen food locker associations.

ITEM	LOUISIANA AND MISSISSIPPI 5 PLANTS	TEXAS AND OKLAHOMA 14 PLANTS	MINNESOTA 14 PLANTS	VIRGINIA AND MARYLAND 10 PLANTS	ILLINOIS 13 PLANTS	NORTH DAKOTA 3 PLANTS	TOTAL
Livestock scales-----	0	1	1	1	2	0	5
Electric hoists-----	3	12	11	10	12	3	51
Hand hoists-----	3	8	5	1	4	1	22
Dehairing machines--	0	0	0	1	3	0	4
Scalding vats-----	5	¹ 13	² 7	10	³ 11	⁴ 0	47
(Thermo-control)----	1	5	0	1	0	0	7

¹One plant skins hogs.

²Seven plants skin hogs.

³Two plants skin hogs.

⁴All three plants skin hogs.

Of the 59 slaughter plants furnishing information, only 7 had livestock scales, but practically all had track scales for weighing carcasses, either in the slaughter plant or in the locker plants. Fifty-one slaughter plants had electric hoists, and 22 hand hoists. Very few were



Some of the larger slaughter plants use mechanical dehairing machines.

equipped with bleeding rails, most of them using hoists while some bled on the floor. Only 4 had dehairing machines. Forty-seven had vats for scalding hogs, but only 7 were equipped with automatic temperature controls.

POULTRY DRESSING EQUIPMENT

Most of the locker plants surveyed had very simple and inexpensive equipment for dressing poultry. Of the 26 associations reporting poultry dressing, 5 used bleeding cones and 5 used cabinets. Twenty-three associations used electric chicken pickers, thirteen used special scalding tanks and 7 hog scalding vats. Only 4 of the special poultry scalding tanks had thermostat controls. A few plants used small galvanized tanks for scalding with no temperature controls. One association had mechanized scalding, picking, and overhead traveling lines similar to those used in larger commercial dressing plants.

PROCESSING ROOM EQUIPMENT

Power equipment generally used in processing includes a saw, grinder, slicer, and frequently a steak tenderizer. Other equipment usually includes a meat block or table, a handsaw, wrapping and stamping table and equipment, scales, trays, knives, and cleavers. Most plants are equipped with an overhead track for moving carcasses from the chill and age rooms into the processing room.

Major equipment used in processing operations included:

Power saws used by all 66 plants reporting. Only 2 plants provided more than one saw. Power grinders also were used by all plants. Size of grinders ranged from 1/2 hp. to 3 hp. Eighty-eight percent used small grinders from 1/2 to 1 hp. with only 12 percent reporting 2 to 3 hp. capacity. Practically all plants used power slicers. None of the plants were equipped with cutting and mixing machinery for making commercial type sausage and meat loaves. A few plants had small hand sausage stuffers used in making pork sausage.

LARD RENDERING EQUIPMENT

Of the 47 plants reporting lard rendering, 85 percent used steam jacketed open kettles, which ranged from 20 gallons to 300 gallons in capacity. The most common size used was 75 gallons. Only 3 plants were equipped with agitators and coolers, and 6 used settling tanks.

All plants used small, hand operated, lard presses, with all but 3 of the screw type. Three plants used hand operated hydraulic presses.

CURING EQUIPMENT

Of the 49 associations from which information was obtained, 73 percent used curing bins, 23 percent used shelves, and only 4 percent used

barrels or vats. The use of bins was most common in Southern plants, while shelves were used mostly in Midwestern plants.

Sinks and barrels were most commonly used for soaking and washing cured meats, but a few plants were equipped with steel tanks.

Forty-eight plants used pickle pumps for pumping hams and shoulders, most of these being in the Midwest and Southwest. Very few Southeastern plants had this type of equipment. Of the associations using pickle pumps, less than half used percentage scales which are needed to determine accurately the amount of pickle to be pumped.

SMOKING EQUIPMENT

In general 3 types of smokehouses were used by locker plants:

1. Small, portable, steel, self-contained smokehouses purchased from equipment manufacturers. These are equipped with automatic, outside temperature controls, and are heated with gas or electricity. The meat to be smoked is hung on rods.

2. Permanent, built-in, larger sized, walk-in smokehouses heated by gas, steam coils, or wood. Meat is hung on poles or hooks. Some are equipped with outside temperature controls but many do not have this equipment.

3. Larger type, permanent, built-in, walk-in types equipped with track for trees or trucks. Meat is hung on trees or in cages and pushed into smokehouse. This type of smokehouse also is heated by gas, steam coils, or wood.

Of the 52 plants equipped with smokehouse facilities, 31 percent had automatic temperature controls, 10 percent hand operated controls, and 59 percent no controls. Sixty-seven percent of the smokehouses were heated with gas; 10 percent were heated with steam coils; 21 percent with wood; and 2 percent were heated by electricity. Seventy percent of the smokehouses were built in the plants and 25 percent were bought from commercial concerns. In most smokehouses heated with wood or gas the smoke was generated within the smokehouse. Those equipped with coils for heating provided smoke from a generator outside of the smokehouse or by means of a pan over a gas flame within the smokehouse. Hickory wood or sawdust was most commonly used to produce smoke.

SOURCE OF LIVESTOCK SLAUGHTERED

Approximately 97 percent of the cattle and 99 percent of the hogs, slaughtered by the associations surveyed, were obtained direct from farmers. Seventy-six percent of the associations received all their cattle direct from farmers, 16 percent obtained 90 to 99 percent from farmers, 5 percent obtained 80 to 90 percent, and only 3 percent obtained as little as half of their supply from farmers. Eighty-seven percent

of the associations received all their hogs from farmers, while the others obtained from 90 to 99 percent from this source (table 6).

LIVESTOCK AND POULTRY SLAUGHTERED AND PROCESSED

Information on volume of livestock slaughtered was obtained from 25 associations. The remaining associations failed to keep accurate records or had not completed a full year's operation. Total number of animals slaughtered was 41,315 head. Hogs made up 56 percent and cattle 44 percent. Table 7 shows the volume of cattle and hogs slaughtered for the fiscal year surveyed.

The volume slaughtered in most associations was relatively small (table 7). Seventy percent of the associations slaughtered less than 600 cattle in a year and only 8 percent over 900 cattle. About 52 percent of the associations slaughtered less than 600 hogs per year, 32 percent from 600 to 900, and only 16 percent over 900 per year.

In the Southern associations a higher proportion of the livestock slaughtered consisted of cattle and calves than in the Midwestern associations. In the Southern associations cattle and calves accounted for 48 percent of the total livestock slaughtered, and hogs 52 percent; in the Midwestern associations cattle and calves 38 percent and hogs 62 percent.

SLAUGHTER VOLUME VERSUS PROCESSING VOLUME

A comparison was made of the volume of livestock slaughtered with volume of meat processed by locker associations. From data obtained from a limited number of associations, it appears that Midwestern associations slaughtered from 50 to 60 percent of the volume processed, while Southern associations slaughtered as much or more than they processed. One reason for the higher percentage slaughtered by Southern associations seems to be that Southern communities are not as adequately supplied with commercial meat products as are the Midwestern communities, because of the distance from commercial meat packing centers.

The proportion of total livestock slaughtered that was processed for locker patrons ranged from 70 percent in Louisiana and Mississippi to 100 percent in North Dakota and averaged 89 percent for the 50 associations furnishing the information. Highest average percentages were in associations located in Midwestern States and lowest in Southern States (table 8). Here, again, it appears that Southern associations have

Table 6. - Source of livestock slaughtered, 1947-48.

SOURCE	CATTLE ¹	HOGS ²
	<i>Percent</i>	
Farmer-----	97	99
Other-----	3	1
Total-----	100	100

¹44 plants surveyed.

²45 plants surveyed.

Table 7. - Number of livestock slaughtered, locker plants served by each slaughtering plant, and locker capacity in 25 associations, 1947-48.

TOTAL LIVESTOCK SLAUGHTERED	CATTLE AND CALVES SLAUGHTERED	HOGS SLAUGHTERED	NUMBER OF LOCKER PLANTS SERVED BY EACH SLAUGHTERING PLANT	LOCKER CAPACITY OF LOCKER PLANTS SERVED
254	125	129	1	486
353	121	232	1	449
520	168	352	2	300
572	173	399	2	830
600	250	350	1	364
640	204	436	1	505
681	304	377	1	299
750	390	360	1	408
812	421	391	1	476
860	287	573	1	567
880	235	645	1	1,059
943	325	618	3	1,405
974	253	721	2	615
1,104	528	576	1	360
1,120	665	455	1	588
1,134	492	642	1	615
1,218	589	629	1	669
1,357	849	508	1	880
1,487	684	803	4	2,911
1,580	480	1,100	1	655
1,600	832	768	1	924
1,713	886	827	1	500
1,900	600	1,300	1	710
¹ 8,388	-	-	1	566
9,875	4,542	5,333	3	1,485
41,315	14,403	18,524	35	18,626

¹No record available on species.

handled considerably more outside custom slaughtering business than Midwestern associations.

While no reliable information was obtained on volume of poultry dressed and processed, this service is becoming of increasing importance in many associations. In addition to dressing poultry for locker patrons, many cooperatives do considerable custom slaughtering for nonmembers and a few dress and freeze poultry for sale. In 21 associations, from which information was available, 87 percent of total poultry slaughtered was for locker patrons and 13 percent for non-locker patrons (table 9). The greatest percentage of non-locker poultry slaughtering was reported by associations in Louisiana and Mississippi where almost half of the poultry slaughtered was for non-locker patrons. In Minnesota, 22 percent was on a custom basis, and in Virginia and Maryland, 10 percent.

Table 8. - Percentage of total livestock slaughtered that was processed for locker patrons, 1947-48.

STATES	ASSOCIATIONS SURVEYED	PERCENTAGE OF SLAUGHTER THAT WAS PROCESSED FOR LOCKER PATRONS
Illinois-----	8	94
Minnesota-----	12	95
North Dakota-----	2	100
Texas and Oklahoma-----	13	84
Louisiana and Mississippi---	5	70
Virginia and Maryland-----	10	93
Average-----	50	89

SEASONAL SLAUGHTER VOLUME

Information was available from 9 associations on the monthly volume of livestock slaughtered. Chart 1 shows the volume slaughtered by four Texas and Mississippi associations and 5 Illinois and Minnesota associations. In the Texas and Mississippi associations the number of cattle and calves slaughtered exceeded the number of hogs slaughtered in 7 out of 12 months. The smallest quantity of cattle and calves were slaughtered in February. This volume increased steadily throughout the spring, summer, and fall months, reaching a high point in October. In the peak month, the volume exceeded the February low by more than 200 percent. The number of hogs slaughtered was greatest in the late fall and early winter months and lowest in the summer months. The seasonal variation was significantly greater in hogs than in cattle and calves.

In the 5 Illinois and Minnesota plants, the number of hogs slaughtered exceeded the number of cattle and calves slaughtered in every month and was more than twice as large in 6 months. Cattle and calf volume was highest in the winter and early spring months and lowest in the late summer. Less seasonal variation was found, however, among these associations than among the Southern associations. Hog slaughtering was

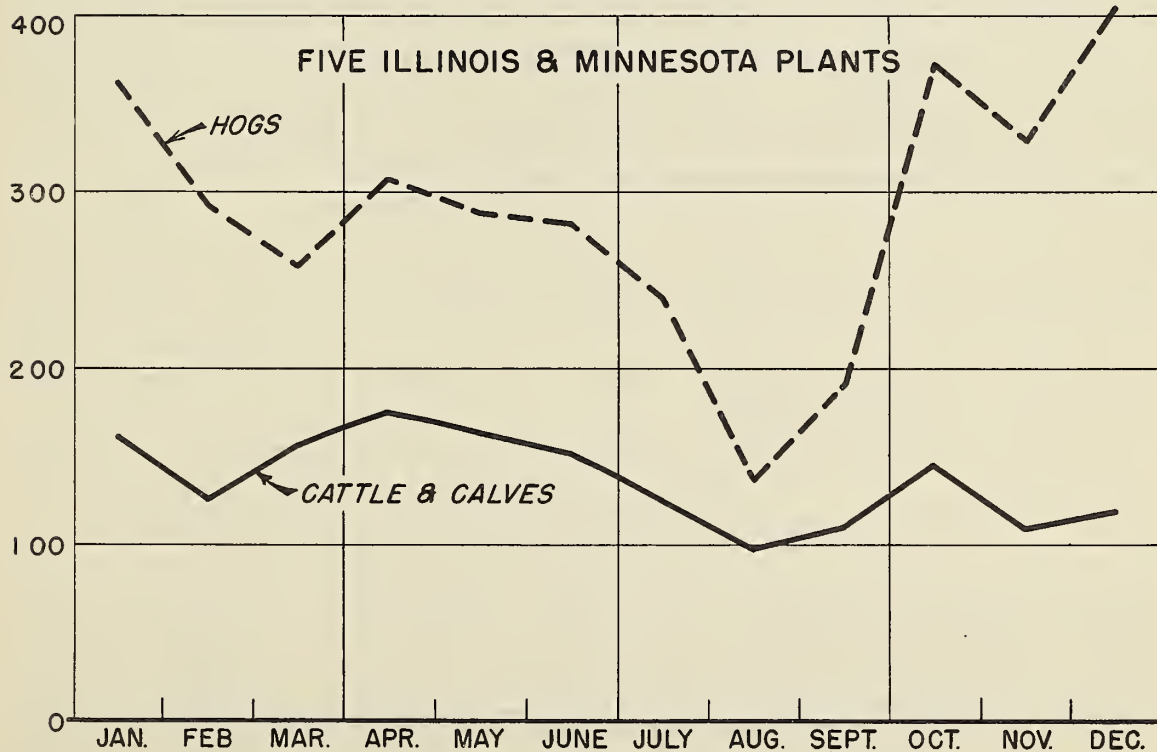
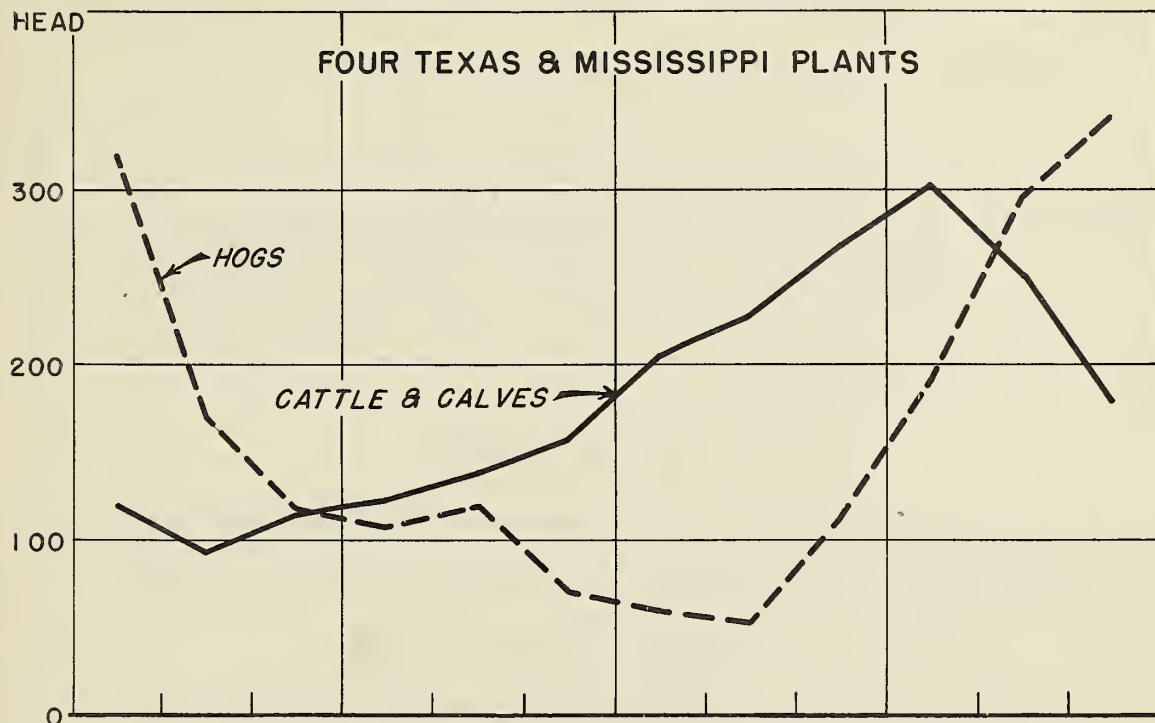
Table 9. - Percentage of poultry slaughtered for locker and non-locker patrons, by States, 1947-48.¹

STATES	ASSOCIATIONS SURVEYED	PERCENT OF POULTRY SLAUGHTERED FOR LOCKER PATRONS	PERCENT OF POULTRY SLAUGHTERED FOR NON-LOCKER PATRONS
Minnesota-----	4	78	22
Texas and Oklahoma---	9	96	4
Louisiana and Mississippi-----	2	52	48
Virginia and Maryland	6	90	10
Average-----	21	87	13

¹Information from Illinois and North Dakota not available.

CHART I

VOLUME OF CATTLE, CALVES, & HOGS SLAUGHTERED



highest in the fall and winter months and lowest in the summer months. The seasonal variation was somewhat similar to the Southern associations except that volume did not drop off quite so fast in the spring and increased faster in the fall.

VOLUME OF MEAT AND POULTRY PROCESSED

The amount of meat and poultry processed by 22 associations is shown in table 10. Average annual amount processed for each locker rented was 388 pounds. This amount varied between regions and between plants. In general the associations in Minnesota showed the largest volume, 678 pounds per locker rented, while those in Virginia showed the lowest, 309 pounds. While it was not possible to obtain a breakdown between volume of meat and poultry processed in this survey, former studies² show that on the average 95 percent of the combined poundage consists of meat and 5 percent of poultry.

RATES AND CHARGES

The rates and charges made for slaughtering livestock, processing meat and poultry, locker rentals, and for bulk and cured storage varied considerably between regions and between associations within regions.

LIVESTOCK SLAUGHTER RATES

Rates for livestock slaughtering varied in amount and method of computing. The 63 associations surveyed had four general methods of charging for cattle slaughtering. Twenty associations, or almost 32 percent, charged by the head, 12 associations, or 20 percent charged on a live weight basis, 17 associations, or 26 percent, charged on a dressed weight basis, and 14, or 22 percent, took the hide as payment for the slaughtering. All of the associations taking the hide for slaughtering were located either in Eastern or Southern States.

²Mann, L. B., and Wilkins, Paul C. Frozen Food Locker Plants, January 1, 1946. U. S. Dept. of Agriculture, Farm Credit Administration Misc. Rpt. No. 105. 1947. 41 p., processed.

Table 10. - Average pounds of meat and poultry processed per locker rented, by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED	AVERAGE POUNDS OF MEAT AND POULTRY PROCESSED PER LOCKER RENTED
Illinois-----	10	350
Minnesota-----	5	678
Texas and Oklahoma-----	3	372
Virginia and Maryland-----	4	309
Total and average-----	22	388

The rate for slaughtering hogs was made either by the head, on a live weight basis, or on a dressed weight basis. Fourteen, or 22 percent of the associations, charged by the head; 26 associations, or 41 percent, on live weight; and 23, or 37 percent, on a dressed weight basis.

Table 11 shows the average charge per head for slaughtering cattle and hogs, by States. All charges made, on a dressed weight basis and on a hide basis, were converted to an estimated per head charge.

The average cost of slaughtering cattle was \$4.24 per head and ranged from \$2.39 in Minnesota to \$7.37 in Virginia and Maryland. Rates charged by associations in the North Central States were approximately half as much as the rates in the Eastern and Southern associations.

The high charge in the East and South is due to the large number of associations taking the hide as payment for slaughtering. Fourteen of the 30 associations surveyed in these regions took the hide as all or part of the slaughter charge. Excluding associations that take the hides, the average charge for slaughtering cattle was \$3.10 per head. A few associations also kept tongues, hearts, and livers, in addition to hides, as slaughtering fees.

The average slaughter charge for hogs in the 63 associations surveyed was \$2.46 per head. In the North Central States the average was \$2.00 per head and in the Eastern and Southern States it was \$3.30 per head. Associations that charged on a live weight basis averaged \$2.20 per head and associations that charged on a dressed weight basis averaged \$2.89 per head when their charges were converted to a per head charge. Thus, when the dressed weight charge was converted to a per head charge, it

Table 11. - Estimated average slaughter rates per head,¹ by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED	RATES FOR SLAUGHTERING	
		CATTLE	HOGS
Illinois-----	14	\$3.14	\$2.15
Minnesota-----	14	2.39	1.73
North Dakota-----	5	3.40	2.35
Texas and Oklahoma	15	5.24	2.80
Louisiana and Mississippi-----	5	4.10	2.50
Virginia and Maryland	10	7.37	3.45
Total and average	63	\$4.24	\$2.46

¹To convert to a per head charge, the slaughter rate in associations that charge on the basis of live weight, dressed weight, or hide in lieu of slaughter charge, the following formula was used. Rate conversions based on cattle weighing 800 pounds in Illinois; 725 pounds in Minnesota and North Dakota; and 650 pounds in all other States. Dressed weight was estimated at 55 percent of live weight and the hide was estimated at 7 percent of live weight. Hides were given a value of 18 cents per pound. The estimated live weight of hogs used in computing average per head charges was 250 pounds in Illinois, Minnesota, and North Dakota, and 350 pounds in all other States. Dressed weight, with head on and leaf in, was estimated at 78 percent of live weight.

was approximately 31 percent higher than the average of the associations that charged on a head or live weight basis.

It was found that among the associations charging on a live weight basis, only two plants had livestock scales. Several of the associations used local public scales but the majority merely estimated the live weight and charged accordingly.

Table 12 shows rates charged for slaughtering cattle and hogs figured on a dressed weight basis for the same 63 associations shown in table 11. The average cost of slaughtering cattle on a dressed weight basis was \$1.11 a hundred pounds. In the North Central States of Illinois, Minnesota, and North Dakota the average charge for slaughtering cattle was 67 cents a hundred pounds of dressed weight. In the East and South the rate averaged \$1.60 a hundred dressed weight. Again, because the associations received a high price for the hides in these areas, charge for slaughtering averaged high. Excluding associations that took the hide, the average charge for slaughtering cattle for all associations was 78 cents per 100 pounds, dressed weight.

Hog slaughtering charges on a dressed weight basis averaged \$1.05 per hundred pounds. Louisiana and Mississippi had the lowest average rate, 77 cents per hundred pounds, and Virginia and Maryland the highest average, \$1.31. Considerable variation was found in rates charged between States but there appeared to be no regional pattern as in the case of charges for slaughtering cattle.

PROCESSING RATES

Rates charged for cutting, wrapping, freezing, and grinding, shown in table 13, averaged \$2.69 a hundred pounds, and ranged from \$2.07 to

Table 12. - Estimated average slaughtering rates per 100 pounds,¹ dressed weight, by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED	CATTLE	HOGS
Illinois-----	14	\$0.68	\$1.08
Minnesota-----	14	.59	.90
North Dakota-----	5	.85	1.20
Texas and Oklahoma-----	15	1.45	1.03
Louisiana and Mississippi---	5	1.14	.77
Virginia and Maryland-----	10	2.04	1.31
Total and average-----	63	\$1.11	\$1.05

¹To convert to a dressed weight basis, the slaughter rate in associations that charged on the basis of live weight, head, or hide in lieu of slaughter charge, the following formula was used. Rate conversions are based on cattle estimated as weighing 800 pounds in Illinois; 725 pounds in Minnesota and North Dakota; and 650 pounds in all other States. Dressed weight was estimated at 55 percent of live weight and the hide was estimated at 7 percent of live weight. The hides were given a value of 18 cents per pound. The estimated weight of hogs used in computing average charges was 250 pounds live weight in Illinois, Minnesota, and North Dakota, and 350 pounds in all other States. Dressed weight, with head on and leaf in, was estimated at 78 percent of live weight.

Table 13. - Average rates for processing a hundred pounds of meat, by States, 1947-48

STATES	RATES CHARGED PER 100 POUNDS FOR:					
	CUTTING, WRAPPING, FREEZING, AND GRINDING	GRINDING ONLY	CURING	SMOKING	RENDERING LARD	CUTTING ONLY
Illinois-----	\$2.33	\$1.00	\$2.95	\$1.73	\$2.93	\$1.00
Minnesota-----	2.07	1.83	3.58	1.86	3.29	1.50
North Dakota-----	2.33	1.67	3.33	2.33	4.00	-
Texas and Oklahoma-----	3.04	1.67	2.36	1.36	2.43	2.10
Louisiana and Mississippi--	2.92	1.50	3.17	1.67	3.50	1.00
Virginia and Maryland-----	3.78	1.90	2.72	1.72	3.44	2.28
Average-----	2.69	1.69	3.03	1.73	3.10	1.93

\$3.78 per hundred pounds. Lowest rates were reported in Minnesota with highest in Virginia and Maryland. Rates for curing averaged \$3.03 per hundred and ranged from \$2.36 in Texas and Oklahoma to \$3.58 in Minnesota. Rates for smoking averaged \$1.73 and ranged from \$1.36 in Texas and Oklahoma to \$2.33 in North Dakota. Rates for rendering lard averaged \$3.10 per hundred pounds and ranged from \$2.43 in Texas and Oklahoma to \$4.00 in North Dakota. Rates for cutting only, averaged \$1.93 per hundred and ranged from \$1.00 in Louisiana, Mississippi, and Illinois to \$2.28 in Virginia and Maryland.

Rates charged for wrapping and freezing poultry ranged from 2 to 4 cents per pound or from 5 to 10 cents per bird and averaged 3 cents per pound, or 9 cents per bird. Rates charged for wrapping and freezing turkeys averaged 27 cents per bird. Rates for a complete job of dressing, wrapping, and freezing averaged 20 cents for fryers, 22 cents for hens, and 51 cents for turkeys. Lowest rates reported were in Texas, Louisiana, and Mississippi, and highest in Illinois and North Dakota (table 14).

Table 14. - Average rate charged per bird for dressing, wrapping, and freezing poultry, 1947-48.

STATES	PLANTS SURVEYED	FRYERS	HENS	TURKEYS ¹
Illinois-----	4	\$0.28	\$0.28	\$0.62
Minnesota-----	6	.23	.23	.38
North Dakota-----	1	.35	.35	-
Texas and Oklahoma-----	7	.16	.18	.60
Louisiana and Mississippi---	3	.16	.22	-
Virginia and Maryland-----	9	.22	.22	.45
Total and average-----	30	.20	.22	.51

¹15 plants reporting.

Rates charged for storing cured meat, reported by 12 associations, ranged from 1 cent to 3 cents a pound per month, or from 50 cents to \$1.50 a bin per month. Most common charge was 1 cent a pound per month.

Bulk zero storage rates, reported by 9 associations, varied widely. Some plants charged on a monthly pound basis, 1 to 1 1/4 cents, others charged on a package basis, 1 cent per month, while others made a flat charge of 50 to 75 cents a month for a certain space equivalent to about one-half of a locker.

LOCKER RENTAL RATES

Average locker rental rates ranged from \$10.73 to \$14.91 per year with an average for the 69 associations surveyed of \$13.19 per locker (table 15). In general, rates charged by Midwestern associations were \$2.22 per locker under that charged by Southern associations. Highest average rates were reported in Virginia and Maryland and the lowest in Minnesota.

SLAUGHTERING AND PROCESSING TECHNIQUES

Methods used in killing livestock varied considerably between plants and between regions. Twenty-six, or 43 percent of the 60 associations reporting, followed the practice of "knocking" cattle with a sledge hammer, while 57 percent "shoot" the animals. Seventy to eighty percent of the Louisiana, Mississippi, and Minnesota plants used the "knocking" method while 75 to 100 percent of the Illinois, North Dakota, and Virginia plants shot the animals.

In killing hogs, 69 percent of the 51 plants reported "shooting" prior to sticking, while 31 percent used the "sticking" method only. There did not appear to be any uniform method followed by regions although sticking was more common in Southern than in Midwestern plants.

Livestock pens are provided by all plants for holding livestock prior to slaughtering. In most plants certain days are designated for slaughtering either cattle or hogs, although some plants slaughter both the same day.

Table 15. - Locker rental rates, by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED	AVERAGE LOCKER RENTAL RATE PER YEAR
Illinois-----	16	\$13.24
Minnesota-----	14	10.73
North Dakota-----	4	12.46
Texas and Oklahoma-----	18	13.78
Louisiana and Mississippi---	7	14.48
Virginia and Maryland-----	10	14.91
Average-----	69	\$13.19

Plants use different methods of handling cattle preparatory to killing. Most plants have knocking pens for holding cattle in the desired position for killing. Others control the animal by pulling its head near the floor with a rope placed about its neck and drawn through a ring in the slaughter-room floor. A few plants use neither the knocking pen nor the ring and rope method but drive the animal into the slaughter room where it is shot. The latter method is not recommended as some cattle become wild and dangerous when in close quarters and need to be under better control.

In the first method, the animal is driven from the holding pen into a knocking chute, where it is then either stunned by knocking or killed by shooting. Most knocking pens are so equipped that after the animal is knocked or shot, one side of the knocking pen drops down and the animal rolls out on the slaughter room floor. In the other two methods, the animal is either stunned or shot at the spot where the next slaughter operation takes place. After stunning or shooting, the animal is then stuck for bleeding either on the floor or on a hoist. The practice of bleeding cattle on a hoist is superior to bleeding on the floor as more blood is removed when the animal is hoisted during the bleeding period. After bleeding, the animal is placed in position for the workmen to remove the hide. Again the hoist may be used to raise and lower the animal to facilitate hide removal. The animals are then eviscerated, washed, split into sides, and placed on overhead tracks to be moved into the chill room.

As stated before hogs are killed by shooting prior to sticking or by "sticking" only. If they are killed by "sticking" they are elevated by a hoist to a height convenient for the workmen to stick them. Hogs killed by shooting usually are placed in small catch pens. Those "stuck" on the hoist are bled while hanging, while those "shot" are either stuck and bled lying on the floor or hoisted for bleeding immediately after shooting. The hogs are then moved to a tank where they are scalded to loosen hair and dirt. After scalding, the hogs move either onto a table for hand scraping or into a dehairer which removes hair mechanically. However, most of the plants studied used the hand scraping method. After cleaning, the animals are eviscerated, washed, split, and moved into the chill room.



Removing hide from beefsteer. Note pritch plates on each side of animal. Knocking pen is shown in rear.

MANHOURS REQUIRED TO SLAUGHTER AND DRESS LIVESTOCK

The average time required for one man to slaughter, skin, and dress one head of cattle, as estimated by operators of 52 associations ranged from 48 minutes in North Dakota to 94 minutes in Virginia and Maryland, and averaged 61 minutes (table 16). The most usual time required was one hour for 31 percent of the associations, 1 1/2 hours for 17 percent, 1/2 hour for 14 percent, and 3/4 hour for 10 percent. Most usual time in Minnesota and Illinois was one hour; Louisiana, and Mississippi, 1 1/4 hours; and Virginia and Maryland, 1 1/2 hours.



Scraping hair from hog by hand is the method followed by most plants.

Time required to slaughter and scrape, or dehair and dress one hog, as reported by 50 associations ranged from 30 minutes in North Dakota to 51 minutes in Virginia and Maryland, with an average for the entire group of 44 minutes (table 17). Most usual time required was 1/2 hour for 60 percent of the associations; 1 hour for 24 percent; and 3/4 hour for 14 percent. Most usual time reported by Minnesota and North Dakota associations was 1/2 hour; Louisiana, Mississippi, and Illinois, 3/4 hour; and Virginia, 1 hour.

DAYS SLAUGHTER SERVICE PROVIDED

Information was secured on the number of days per week slaughtering service was provided. Twenty-two percent of the associations operated their slaughter facilities 3 days a week; 18 percent, 2 days a week; and 20 percent, 5 days a week (table 18). Only 13 percent of the associations operated slaughter facility one day a week, while 11 percent operated 6 days a week.

Table 16. - Average time required to slaughter one head of cattle, by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED	AVERAGE MAN-MINUTES TO SLAUGHTER 1 HEAD OF CATTLE
Illinois-----	10	51
Minnesota-----	14	54
North Dakota-----	3	48
Texas and Oklahoma-----	13	59
Louisiana and Mississippi---	5	71
Virginia and Maryland-----	7	94
Total and average-----	52	61

Table 17. - Average time required to slaughter one hog, by States, 1947-48.

STATES	ASSOCIATIONS SURVEYED REPORTING	AVERAGE MAN MINUTES TO SLAUGHTER 1 HOG
Illinois-----	8	46
Minnesota-----	14	34
North Dakota-----	3	30
Texas and Oklahoma-----	12	50
Louisiana and Mississippi---	5	46
Virginia and Maryland-----	8	51
Average-----	50	44

Information received on volume of slaughtering in these associations indicates that in most associations the amount of livestock slaughtered could all be handled in one or two days per week. Associations operating their slaughter facilities a greater number of days do so primarily for the convenience of the patrons.

POULTRY DRESSING

Dressing poultry has grown during recent years until in some associations it is one of the main sources of revenue. Over 50 percent of the 70 associations surveyed reported furnishing this service.

Techniques followed by associations varied from those using all hand labor with little or no specialized equipment to one plant equipped with electric pickers, scalding tanks, and overhead moving lines similar to large commercial dressing plants.

The method followed by most plants was to stick and bleed in cones, cabinets or from ropes hanging from the ceiling; scald; remove feathers with an electric picker; cool in water; draw, chill, and wrap; and sharp freeze³.

³A detailed report of typical plant layouts and operations of selected small poultry dressing plants by George A. Amacker, is scheduled to be published by the Farm Credit Administration.

Table 18. - Number of days per week slaughtering service was provided,¹ 1947-48.

DAYS PER WEEK SLAUGHTERING SERVICE IS PROVIDED	ASSOCIATIONS SURVEYED	PERCENTAGE OF TOTAL ASSOCIATIONS REPORTING
1-----	7	13.0
2-----	10	18.5
3-----	12	22.2
4-----	8	14.8
5-----	11	20.4
6-----	6	11.1
Total-----	54	100.0

¹Some plants have different schedules for summer and winter. In such cases the winter schedule is used.

The volume of poultry dressed and processed for nonlocker patrons undoubtedly will continue to increase as new small-type equipment is developed, techniques improved, labor efficiency increased, and sales outlets expanded.

CHILLING AND AGING

Forty percent of the 35 associations reporting indicated that pork was held in the chill room 12 to 24 hours; 17 percent from 25 to 36 hours; 26 percent, 37 to 48 hours; and 17 percent from 49 to 72 hours. Most operators, however, reported that they tried to move pork to be cured out of the chill room in less than 48 hours, but during periods when a large volume was being handled this was not always possible.

Seventy percent of the associations chilled and aged beef from 6 to 9 days. The most usual time was 7 days. Some associations reported aging beef from 2 to 4 weeks but the amount aged was limited largely to a small volume of well-finished cattle.



Beef carcasses are hung in the chill room at 34° to 38° temperature prior to cutting and processing.

Fifty-seven of 67 associations reporting operated their chill and age rooms at uniform temperatures while the balance showed differences of only 2 to 3 degrees. Chill room temperature ranged from 28 to 40 degrees, and the most common was from 34 to 38 degrees. Age room temperatures ranged from 32 to 40 degrees, with the most common from 34 to 38 degrees.⁴

CUTTING, WRAPPING, AND FREEZING

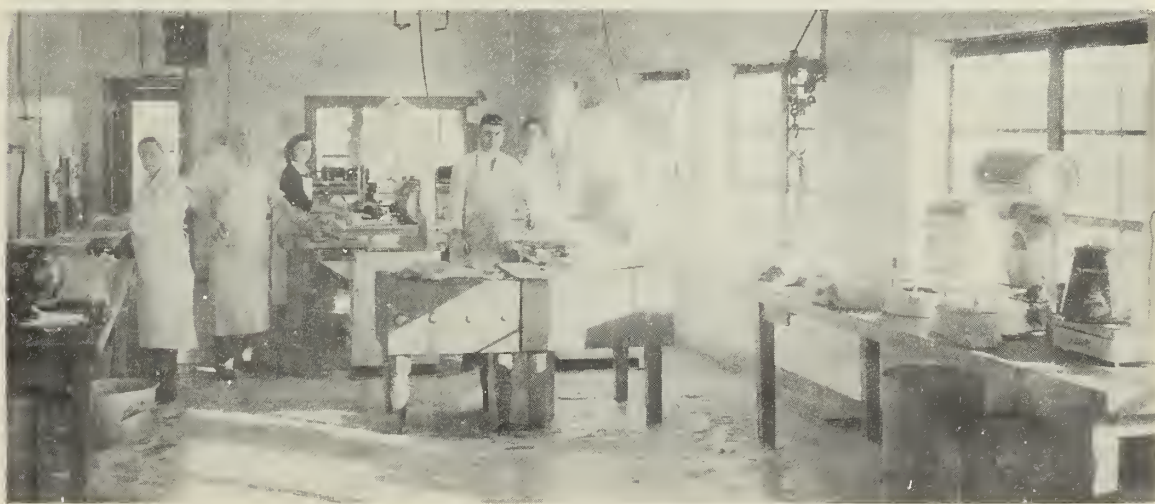
The basic processing service in frozen food locker plants is chilling, cutting, wrapping, and freezing fresh beef and pork. Approximately 86 percent of all locker associations, according to a survey made in 1947,⁵ provided this service. Frequently, other services such as slicing, tenderizing, grinding, and sausage making also are included.

Information was secured from 50 associations on the type of wrapping paper and method of wrapping generally used. Seventy-two percent of the associations used locker paper; 24 percent, laminated paper; 2 percent, cellophane; and 2 percent, butcher paper. A few associations also used aluminum foil. For associations using more than one type of paper, the preferred or most generally used type was indicated.

Sixty-eight percent of the associations used the single wrap method and 32 percent a double wrap. Seventy-four percent used a butcher type wrap and 26 percent the drug store wrap. The majority of the associations used tape for fastening the wrap. Twine was used in most of the other associations, but a few used stapling machines. Poultry was generally wrapped whole in regular locker paper. Some used cellophane or laminated paper and a few associations plastic bags.

⁴All temperatures referred to in this report are designated as degrees Fahrenheit.

⁵Mann, L. B., Wilkins, Paul C. - Cooperative Frozen Food Locker Associations. U. S. Dept. of Agriculture, Farm Credit Administration Misc. Rpt. No. 116. 1948. 36 p., processed.



This processing room of a large centralized processing plant serves 5 branches.

Pork sausage was manufactured by most associations largely for locker patrons. The usual procedure was to package the sausage in 1 or 2 pound containers. However, a few associations had sausage stuffers and packaged in muslin-type bags.

All associations were equipped with sharp freezing rooms. Most usual temperature maintained in the rooms was zero to 10° below, with some plants operating their freezers down to 20° below zero.

CURING TECHNIQUES

The curing and smoking of pork is one of the most profitable operations in a locker plant. However, to produce a high quality and uniform product day after day calls for accurate and careful attention to details, such as proper chilling and curing room temperatures, cleanliness, accurate measurements of curing materials, proper timing, and proper temperature controls during the drying and smoking period.

In this study an attempt was made to obtain detailed information as to methods followed by operators from the time the hogs were slaughtered until the product was removed from the smokehouse.

A variety of methods are used in curing pork. The principal ones are straight dry curing, brine curing, artery pumping with curing pickle in combination with either dry or brine cure, and stitch pumping with curing pickle in combination with either dry or brine cure.

Of the 55 associations reporting 18, or 33 percent, followed straight dry curing and 37, or 67 percent, combined pumping and dry curing. Only one of the associations cured in brine after pumping. In this association, meat was submerged in a salt brine solution and a procedure followed similar to that used in commercial packing operations. The straight dry curing method was limited largely to the Southern States where, with the exception of Texas, it was the general practice. Pumping in combination with dry curing was the established practice in most Midwestern associations. Of the 37 associations that pumped before dry curing 14, or 38 percent, used the artery system, while 23, or 62 percent, "stitch pumped" hams and shoulders.



Practically all associations reporting the use of percentage

After cutting and wrapping, meat is placed in the sharp freeze room and frozen at below zero temperature before storing in lockers.

scales used an amount of pumping pickle equal to 10 percent of the weight of the meat pumped. This is the percentage recommended by most curing authorities. However, a substantial portion of plants did not use percentage scales in pumping.

Nearly half of the 24 associations reporting maintained a temperature of 38° to 40° for pumping pickle, and the same temperature for meat. A few plants reported that both meat and pickle were maintained at room temperatures. A limited number maintained pumping pickle temperatures as low as 34° with meat at 45° . One plant used 50° temperature for pickle with meat temperature at 38° , while another plant used pickle at 35° , and meat temperature ranged from 40° to 50° .

In several plants, it appeared to be a common practice to cut up hog carcasses and leave cuts to be cured in the cutting or processing room at room temperature until enough meat accumulated to start pumping or applying curing mixture.

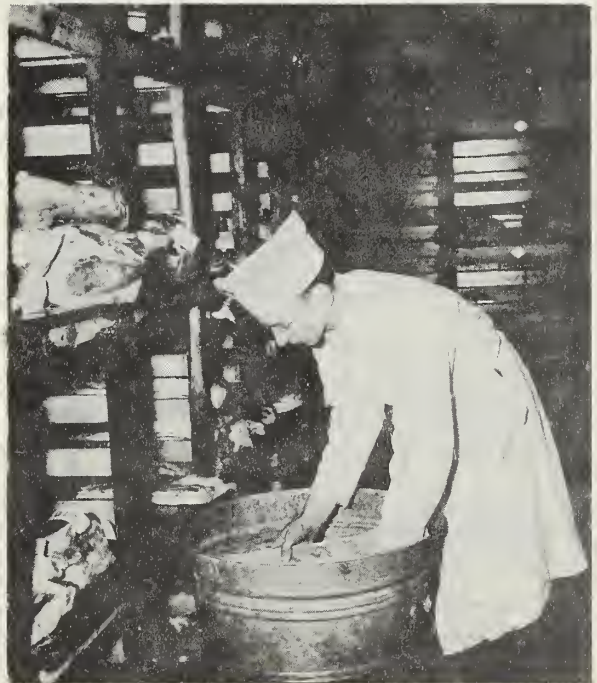
The temperature recommended by curing and smoking authorities for pumping pickle and pork is 40° . The survey showed that 50 percent of the associations appeared to be following these recommendations. Temperatures maintained in curing rooms ranged from 34° to 50° and the most common reported was from 36° to 40° .

KIND AND AMOUNT OF CURING MIXTURES USED

Commercially prepared curing mixtures manufactured and sold by 8 companies were used by all but 2 of the 55 associations reporting. The amount of curing mixture used per 100 pounds of meat ranged from 3 to 8 pounds with 50 percent of the plants using from 4 to 6 pounds. A least 30 percent of the associations followed the practice of using just enough salt to cover the meat, but did not weigh the mixture.

LENGTH OF CURE

The length of time hams, shoulders, and bacon were cured varied with the methods followed in curing, strength of pumping brine, weight of the product, and the methods followed by patrons in storing the finished product. Where hams and shoulders were artery pumped they were cured from 7 to 21 days, and the most usual time



Applying curing mixture to fresh bacon sides. Meat is then placed on shelves and cured at 40° temperature.

was 14 days. Hams and shoulders cured in 7 to 14 days, were usually very mildly cured and practically all were stored in lockers. While some hams and shoulders were frozen and stored whole, many plants cut them into slices or roasts. Most bacon was sliced and wrapped before being placed in the locker. Stitch pumped hams were cured from 14 to 40 days. About 60 percent of the plants using the stitch-cure method held hams and shoulders from 14 to 25 days and 25 percent held them from 26 to 35 days. Heavy hams and shoulders were held in cure from 35 to 40 days.

In the case of the straight dry curing method, hams and shoulders were cured from 2 to 3 days per pound of weight, or usually from 25 to 40 days.

Curing time for bacon ranged from 7 to 28 days and the most common time was from 10 to 14 days. In many instances, patrons' bacon was cured for the same period as hams and shoulders to avoid the trouble of keeping a separate record of these cuts.

SOAKING METHODS

The time used in soaking cured pork products prior to smoking varied considerably (table 19). Eleven different time schedules were reported by the 37 associations furnishing information. The time used ranged from "washing only" to 6 hours. Most usual time, used by 43 percent of the associations, for soaking hams and shoulders was 2 to 3 hours, while next most common was "wash only," used by 22 percent. Sixteen percent of the associations, mostly located in the Southern States where no pumping was carried on and longer cures were used, soaked hams and shoulders from 4 to 6 hours.

In the case of bacon, a similar range of soaking time was reported from "washing only" to 6 hours. Forty percent of the associations followed the practices of "washing only" or soaking for 1 hour or less, while 43 percent soaked from 1 to 3 hours and only 17 percent soaked longer than 3 hours.

Table 19. - Soaking time used by locker associations, 1947-48.

METHOD AND TIME OF SOAKING	HAMS AND SHOULDERS		BACON	
	NUMBER OF ASSOCIATIONS	PERCENT	NUMBER OF ASSOCIATIONS	PERCENT
Washing only--	8	22	8	29
1 hour or less	1	3	3	11
1-2 hours-----	4	11	4	14
2-3 hours-----	16	43	8	29
3-4 hours-----	2	5	2	7
4-6 hours-----	6	16	5	10
Total----	37	100	28	100

SMOKING METHODS

While curing and smoking operations in locker plants appear to be one of the most profitable and most popular services rendered, yet an analysis of the methods followed by the 32 associations reporting seemed to indicate lack of uniformity, both as to time and temperatures.

The three principal methods of cure used with hams and shoulders, as already pointed out, were: (1) Artery pumping in combination with dry-cure; (2) stitch pumping with dry cure; and (3) dry cure only. Curing methods to a considerable degree influence both time and temperature maintained in the smoking process.

SMOKING HAMS AND SHOULDERS

Various methods were used by 32 associations to smoke hams and shoulders (table 20). In those associations using the artery pump process of curing, time in drying, prior to smoking, ranged from no drying to 15 hours with temperature from 100° to 150° . Most common time for drying was from 8 to 12 hours with a temperature of 100° to 125° . For the associations that preceded smoking with drying, smoking time ranged from 8 to 72 hours and the temperature from 110° to 180° . Most usual time for smoking was from 12 to 14 hours with temperatures from 110° to 125° . A considerable number of hams and shoulders were tenderized or precooked at 140° to 165° . For associations which reported no drying prior to smoking, time of smoking ranged from 12 to 72 hours and temperatures from 110° to 170° . Most usual time was from 30 to 48 hours at 110° to 120° .

For associations using the stitch method of pumping hams and shoulders the period of drying preceding smoking ranged from no drying to 24 hours with temperatures from 110° to 160° . Most usual time of drying was from 3 to 10 hours with temperatures from 110° to 130° . For associations which preceded smoking with a drying period time of smoking ranged from 6 to 72 hours with temperatures from 100° to 160° . Most usual time for smoking was from 24 to 36 hours and most usual temperatures from 110° to 130° . For three associations, which reported no drying period before smoking, the time reported for smoking ranged from 24 to 48 hours. None of these associations had any temperature controls during the smoking period.



Cured hams and shoulders are hung in smokehouses for drying and smoking under controlled temperatures.

Table 20. - Methods used in smoking hams and shoulders, by each of 32 associations, 1947-48.

CURING METHOD	DRYING PERIOD		SMOKING PERIOD	
	HOURS	TEMPERATURE DEGREES F	HOURS	TEMPERATURE DEGREES F
Artery pumped and dry curing	no drying period		12	170
	no drying period		30-36	120
	no drying period		72	110-120
	6	110	24	180
	8	125	13-14	145-165
	8	120	8	150
	12	125	12	125
	12	150	12	150
	12	138-140	8	138-140
	14	110-120	14	110-120
	15	100-110	24	140-165
Stitch pump and dry curing	no drying period		24-36	no temp. control
	no drying period		36	no temp. control
	no drying period		48	no temp. control
	2-3	110-120	24	128-130
	2-6	135	24	110
	3	110-130	20-30	110-130
	3-5	120-160	12-24	100
	3-4	110-130	18-24	130
	6	135-140	6	135-140
	8	120	24	120-135
	10	120-130	24	140-160
	10	110	10	fire off
	12	120	12	120
	12	130-135	40	130-135
	12-14	110	24	100
	14-20	110-120	48-72	110-120
	16	135-140	48	120
	24	120	72	128
Dry curing only	no drying period		48	110
	no drying period		48	90-100
	12-15	100	72	120

For three associations using the dry curing method with no pumping, only one dried before smoking. Drying time was 12 to 15 hours with a temperature of 100°. During the smoking period, time ranged from 48 to 72 hours with temperatures from 90° to 120°.

Some of the wide differences in time and temperatures reported were due to differences in type of product desired such as mild cured and pre-cooked hams and shoulders which were stored in lockers, and straight cured heavier smoked hams to be stored on the farms. However, it appeared that there was too much variation and lack of standardization in both the curing and smoking process to guarantee a uniform high quality product.

Another weakness noted was that only a few associations reported the taking of bone temperatures of hams and shoulders.

SMOKING METHODS USED FOR BACON

Information secured from 28 associations smoking bacon showed approximately the same variation in time and temperatures as for hams and shoulders, (table 21). Five plants had no drying period prior to smoking while the remaining associations dried for various lengths of time. Drying period for those associations drying prior to smoking ranged from 2 to 24 hours with temperatures from 80° to 150°. Most usual time for drying was from 3 to 8 hours with temperatures from 110° to 130°. Time of smoking ranged from 8 to 72 hours and temperatures from 80° to 170°. Most usual smoking time ranged from 8 to 14 hours although a sizable percentage ranged from 36 to 72 hours. Most common temperatures for smoking reported were from 100° to 130° with a few reporting temperatures in the 160° to 170° range or down to 80° to 90°.

LARD RENDERING TECHNIQUES

The practice followed in most plants is to run pork fat and trimmings through a 1/2 inch plate in a grinder, although a few plants cut fat into small pieces before placing it in the kettle. Fat is then cooked for about 3 hours at 235° to 250° temperature.

During the cooking process lard is stirred by hand and when most of the cracklings sink to the bottom the lard is drawn off either into a large container or into lard cans which are then placed in the chill room for cooling. Most operators prefer the latter method. While this method produces a fairly satisfactory product for individual farm patrons, if the plant desires to manufacture a surplus for sale to retail stores, restaurants, and bakeries it may be advisable to provide settling tanks, agitators, and coolers in order to produce lard of whiter color and finer texture. After the lard is drawn from the kettle, the cracklings are placed in a screw or hydraulic type press which extracts additional lard.

Table 21. - Smoking methods used for bacon, by each of 28 associations, 1947-48.

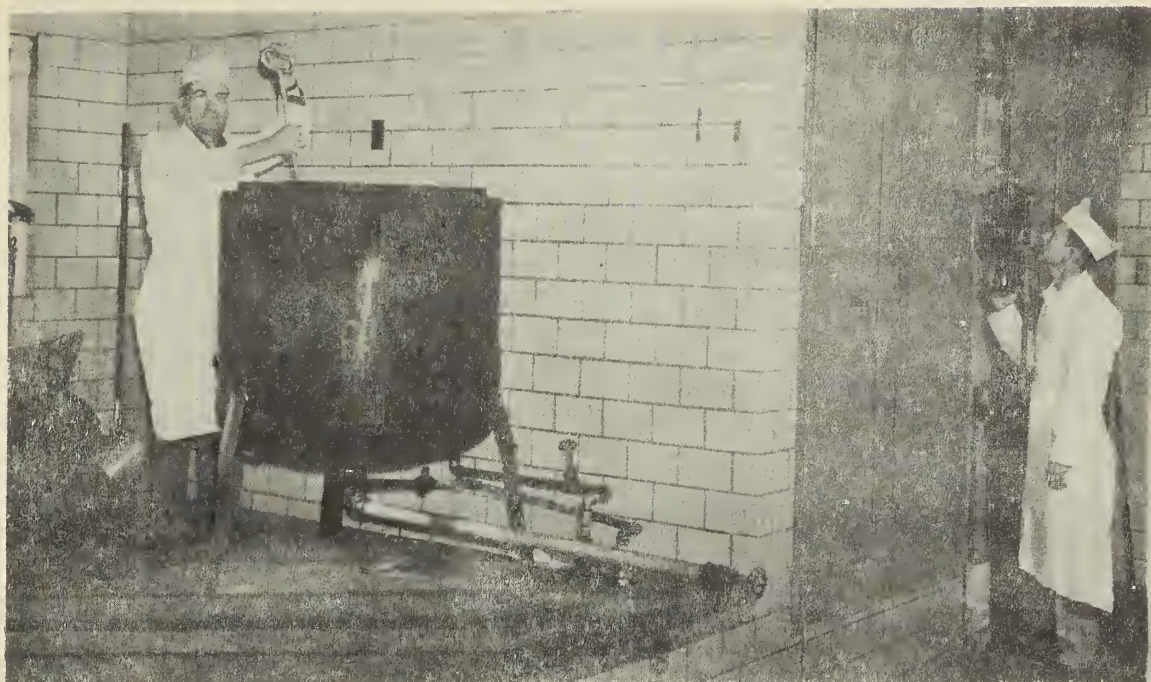
DRYING PERIOD		SMOKING PERIOD	
HOURS	TEMPERATURE DEGREES F	HOURS	TEMPERATURE DEGREES F
no drying period		12	170
no drying period		48	110
no drying period		24	150-180
no drying period		72	118-122
no drying period		48-72	110-120
2-3	110-120	18	120-130
2-6	135	24	110
3	110-130	20	128-130
3	120	20	120
3-4	110-130	12-18	130
3-5	90	48	85-90
6	138	6	138
6	110	24	120
6	135-140	12	118-122
6-8	120-130	24	120-130
8	120	8	120-135
8	150	8	130
10	120-130	24	140-160
10	110	10	fire off-no heat
12	120	12	140
12	100	12	125
12	150	12	150
12	115	40	130
12-14	110	24	100
12-15	100	72	120
14	110-120	12	120-138
16	135-140	36	120
24	80	24	80

BY-PRODUCT UTILIZATION

The survey found very little processing of either edible or inedible by-products by cooperative locker plants. None of the associations surveyed had equipment for manufacturing commercial type sausage or meat loaves and only one association had equipment for rendering-out grease and tannage from inedible by-products.

EDIBLE BY-PRODUCTS

Information obtained from 30 associations, indicates that more than one-fourth of the associations obtained edible by-products such as hearts, tongues, livers, kidneys, and melts from patrons, either as a part of the slaughtering fee or because patrons did not care to use them (table 22).



Rendering lard in steam jacketed lard kettle. Employee at right is checking temperature controls on smokehouse.

While a few associations obtained fairly satisfactory outlets for some of these by-products to stores, institutions, and other outlets, many of the plants received very little for them and some associations were selling these edible products to rendering companies along with inedible by-products at relatively low prices.

If proper use were made of these products along with trimmings and tripe, a profitable sausage business might be developed which would provide additional revenue. Commercial meat packing plants have for years depended upon their sausage manufacturing operations for one of their main sources of profit.

INEDIBLE BY-PRODUCTS

Another weakness indicated by the survey was in handling inedible by-products. Only one of the 56 plants surveyed reported rendering inedible

Table 22. - Method of edible offal disposal, 1947-48.

	ASSOCIATIONS SURVEYED	PERCENTAGE OF TOTAL
Sold by plant-----	8	26.7
Retained by patron-----	21	70.0
Other-----	1	3.3
Total-----	30	100.0

offal into grease and wet tankage, which was then sold to a commercial rendering company. Four plants rendered out tallow and disposed of it to local restaurants or to rendering companies. Table 23 shows the principal outlets for inedible offal for 56 locker associations. Rendering companies were the principal outlet for offal, bones, and tallow. Approximately 60 percent of the associations use this outlet. Local farmers provided an outlet in nearly 30 percent of the associations, while the balance utilized other local outlets, or destroyed the offal. An analysis of the returns received from these by-products shows that 70 percent of the associations received nothing for the offal, 36 percent had no receipts from bones, and 18 percent no receipts from tallow. The practice of giving away offal and bones appeared to be more prevalent in the South than in the Midwest.

During the period of this survey, fall and spring of 1947-48, rendered grease was selling at 15 to 20 cents per pound and tankage from \$88 to \$100 per ton. It appears that most of the associations were not obtaining adequate returns from the sale of their inedible by-products.

Another important inedible by-product in locker plants is hides. Approximately 75 percent of the hides handled by the associations reporting were sold to rendering companies and the balance to dealers. Of the 56 associations reporting, 73 percent sold hides uncured or green, 23 percent partially cured, and 4 percent sold them both ways (table 24).

While margins taken by associations ranged from 1 to 10 cents per pound the most common spread was from 2 to 4 cents (table 25). Narrowest margins of from 2 to 2 1/2 cents were reported in Minnesota and North Dakota, while widest were in Virginia at about 7 cents. Louisiana, Mississippi, and Texas margins averaged from 4 to 4 1/2 cents.

For the survey period average prices received for hides sold by locker associations ranged from 14 to 19 cents per pound. An attempt was made to compare hide prices received by locker associations in each State. However, due to different dates on which the plants were surveyed,

Table 23. - Number of associations reporting and methods of disposal of inedible products, 1947-48.

OUTLET	OFFAL			BONES			TALLOW		
	TOTAL	SOLD	GIVEN AWAY	TOTAL	SOLD	GIVEN AWAY	TOTAL	SOLD	GIVEN AWAY
Rendering company	34	15	19	33	33	-	32	32	-
Farmer-----	16	1	15	16	1	15	15	6	9
Local outlets----	4	1	3	5	2	3	4	4	-
Rendered-----	-	-	-	-	-	-	4	4	-
Destroyed-----	2	-	2	2	-	2	1	-	1
Total-----	56	17	39	56	36	20	56	46	10

Table 24. - Type of hides sold, 1947-48.

TYPE	ASSOCIATIONS SURVEYED	PERCENTAGE OF TOTAL
Green-----	41	73
Cured-----	13	23
Green and cured-----	2	4
Total-----	56	100

during which time the market price changed, and also because of the practice of selling hides on an ungraded basis, it was not possible to make an accurate comparison. However, in comparing prices received by locker associations on comparable dates with quoted prices for steer and heifer country hides at Chicago it appeared that prices received by locker associations were from 15 to 30 percent below market quotations. Compared with quoted prices on small packer hides at Chicago, which should be more comparable to locker plant hides, prices received by locker associations were generally 20 to 40 percent under market quotations. Too few associations received proper price differentials for type and class of hides sold. From this analysis it would appear that one of the major leaks in locker-slaughter plant operations is in the utilization and sale of by-products.

SANITATION

One of the most important factors in the successful operation of any food processing plant is sanitation. In general sanitary conditions in most plants were reasonably good and much better than usually associated with local slaughtering and poultry dressing plants. However, in this survey, unsanitary conditions were noted in practically all departments of some plants.

Some plants maintained dirty and poorly drained livestock pens causing disagreeable odors as well as providing favorable breeding places for flies and other insects. Dirty floors, walls, and equipment in slaughter

Table 25. - Margin taken on hides by associations, 1947-48.

MARGIN PER POUND (CENTS)	ASSOCIATIONS SURVEYED
.01-----	4
.02-----	6
.03-----	7
.04-----	8
.05-----	4
over .05-----	4
Total-----	33

rooms, coupled with inadequate sewage disposal facilities, were observed in several plants. In a few instances, sewage was disposed of by means of an open ditch into a small creek which failed to carry off waste in dry weather causing bad odors and providing ideal insect breeding places.

Poor housekeeping methods were noted in several processing rooms such as dirty floors, equipment and soiled aprons. Smoking by butchers and others in processing rooms was another bad practice noted. In several plants, meat and other food products were placed on the floor in chill and age rooms, due to lack of space. In others blood was noted on floors and bad odors were prevalent. In still others, dirty sawdust was observed on floors. In some plants, carcasses appeared to be wet and slimy.

Curing room conditions in a large number of plants visited appeared unsatisfactory. Inadequate and poorly placed floor drains, as well as improper pitch of floors to drains, found in numerous plants, resulted in wet floors and high humidity.

Excess mold, both on cured products in curing bins, and on walls were noted. The practice of allowing patrons to leave cured meat in curing rooms resulted in accentuating the spread of mold to products being cured. The use of blowers in curing rooms tends to reduce moisture and retards the growth of mold. Bad odors were noted in a number of curing rooms.

In some plants where lard rendering was carried on in the slaughter room there appeared to be too much chance for contamination from dirt and odors from slaughtering operations to produce high quality lard.

While it should not be inferred from these criticisms that a majority of the plants surveyed were operated in an unsanitary manner in all or most of their departments, yet lack of sanitation was evident in too many instances to be overlooked.

Ways and means of eliminating most of the causes for unsanitary operations are available and some suggestions are offered in the conclusion of this report.

EMPLOYEES NEEDED

The number of full-time employees needed to operate a locker plant with slaughtering facilities depends upon such factors as size of plant, volume processed, kind and variety of services rendered, seasonal character of raw products to be processed, type of help, and the efficiency of labor and management.

An analysis of information obtained from 41 cooperative associations on the most usual number of full-time employees used is shown in table 26. From 2 to 3 employees were used by plants operating 300 to 499 lockers, 3 to 4 employees in plants with 500 to 799 lockers, and from 4 to 7 in plants with from 800 to 1100 lockers. The number of full-time employees includes management and office employees.

Table 26. - Most usual number of full-time employees¹ operating plants of indicated size, 1947-48².

SIZE OF PLANT LOCKERS	NUMBER OF EMPLOYEES PER LOCKER PLANT
300-499-----	2-3
500-799-----	3-4
800 and over ³ -----	4-7

¹From one to two part-time employees were usually hired during peak periods.

²Information secured from 41 plants.

³Largest plant surveyed had 1,059 lockers.

To take care of peak loads during the winter months most plants use from 1 to 2 additional employees, although several of the plants used no extra help. However, there are numerous variations both above and below these averages or most commonly reported figures. Nevertheless, it is felt that the information presented may be of value in providing a rough guide for determining the amount of labor generally needed by plants of different size and type of operation.

RECEIPTS, EXPENSES, AND NET SAVINGS

Information on receipts, expenses, and net savings for the year 1947-48 was secured from 39 associations operating 39 slaughter and 62 locker plants. The plants had a total of 29,898 lockers installed, of which 26,792, or 90 percent were rented. Total receipts amounted to \$1,028,000; expenses, before income taxes and interest, \$920,000; and net savings \$108,000. (Table 27 and chart 2).

Total receipts averaged \$38.38 per locker rented; expenses, before income taxes and interest, \$34.35; and net savings, \$4.03. Locker rental receipts averaged \$12.82 per locker rented, or 38.8 percent of total receipts. Slaughtering receipts averaged \$4.57, or 6.9 percent; receipts from other processing \$13.93, or 39 percent; inedible sales \$3.68, or 9.6 percent; and other receipts, principally merchandise sales, \$3.38 per locker rented, or 5.7 percent of total receipts.

Expenses averaged 89.5 percent of receipts, or \$34.35 per locker rented. Labor cost amounted to \$17.31 for each locker rented, or 50.4 percent of all expenses. Utilities accounted for 9.1 percent; fixed expense (depreciation, licenses, taxes, and repairs), 17.1 percent; and other expense (supplies, office expense, etc.), 23.4 percent.

Net savings averaged \$4.03 per locker rented before payment of income taxes and interest, or 10.5 percent of receipts. Of the 39 associations surveyed, 6 operated at a loss, 6 associations had savings of less than \$2 per locker rented, 11 made between \$2 and \$6 per locker, 12 made between \$6 and \$10, and 4 associations made over \$10 with 2 of these reporting over \$16 net savings per locker (chart 3).

Table 27. - Associations surveyed, plants operated, lockers rented, receipts, expenses, and net savings, by States, 1947-48.

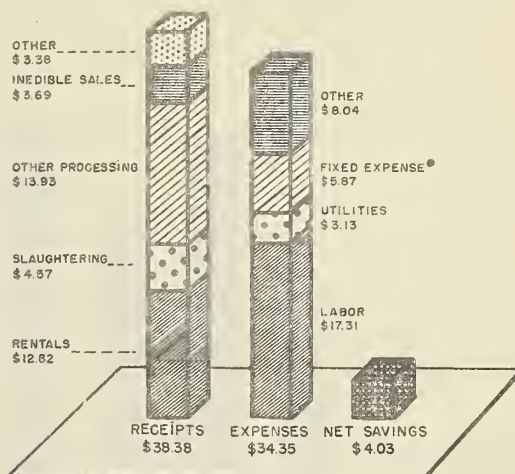
STATES	ASSOCIATIONS SURVEYED	LOCKER PLANTS OPERATED	TOTAL LOCKERS RENTED	TOTAL RECEIPTS	TOTAL EXPENSES	TOTAL NET SAVINGS ¹	PER LOCKER RENTED		
							RECEIPTS	EXPENSES	NET ¹ SAVINGS
Illinois-----	9	22	10,708	\$341,494.87	\$290,349.75	\$51,145.12	\$31.89	\$27.11	\$4.78
Minnesota-----	9	10	4,236	146,748.16	134,269.76	12,478.40	34.64	31.70	2.94
Texas-----	11	17	7,206	333,062.38	293,632.15	39,430.23	46.22	40.75	5.47
Louisiana and Mississippi-----	4	4	1,420	99,286.34	87,894.43	11,391.91	69.92	61.90	8.02
Virginia-----	6	9	3,222	107,738.16	114,271.41	(6,533.25)	33.44	35.47	(2.03)
Total and average--	39	62	² 26,792	\$1,028,329.91	\$920,417.50	\$107,912.41	\$38.38	\$34.35	\$4.03

¹Before payment of income taxes and interest.

²The 62 plants had 29,898 lockers installed and averaged 90 percent rented.

The greatest savings were among the Louisiana and Mississippi associations. Four associations operating individual plants in those States had average savings of \$8.02 per locker rented (table 27, chart 4). Total receipts were highest at \$69.92; also expenses at \$61.90 per locker rented. Eleven associations operating 17 plants in Texas were second highest in net savings. These plants had savings of \$5.47 per locker rented. Receipts averaged \$46.22 per locker and expenses \$40.75. Six associations operating 9 plants in Virginia experienced an average loss of \$2.03 per locker rented. These associations had below average receipts of \$33.44 per locker and above average expenses of \$35.47.

CHART 2
AVERAGE RECEIPTS, EXPENSES AND NET SAVINGS
PER LOCKER RENTED, BEFORE INCOME TAX
AND INTEREST, 1947-48



The major factors affecting operations in the various States are:

* DEPRECIATION, LICENSES, TAXES, AND REPAIRS

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low rates but substantial volume of business in Illinois and Minnesota; high rates and large volume of business in Texas, Louisiana, and Mississippi; and high rates and very low volume of business in Virginia.

A composite depreciation rate for all fixed assets averaged 4.6 percent. These rates varied widely, however, among plants and ranged from a low of 2 percent to over 8 percent. Due to the relatively high average investment in plant facilities, the return on investment, before payment of income taxes and interest, averaged slightly more than 5 percent. Approximately 38 percent of the associations operated at a loss, or had returns of less than 5 percent on their investment in fixed assets. Twenty-eight percent had returns between 5 and 10 percent and 34 percent of the associations had returns of over 10 percent (table 28). Several associations with savings amounting to more than 15 percent of the investment in fixed assets had \$70 to \$80 invested per locker in the facilities. On the other hand several associations with relatively low investments were unable to make satisfactory savings.

As indicated previously the cost of labor and management is about half of the total cost of operating a locker plant. It is important that this cost be watched constantly and every effort made to utilize labor and management efficiently. One method of measuring the utilization of labor and management is to compare this cost with the receipts from processing. It was found that on the average 98 cents was spent for labor and management for each dollar of processing receipts (table 29). Minnesota, Louisiana, and Mississippi had the lowest average cost at

CHART 3

NUMBER OF ASSOCIATIONS WITH INDICATED NET SAVINGS OR LOSS PER LOCKER RENTED BEFORE INCOME TAXES AND INTEREST, 1947-48

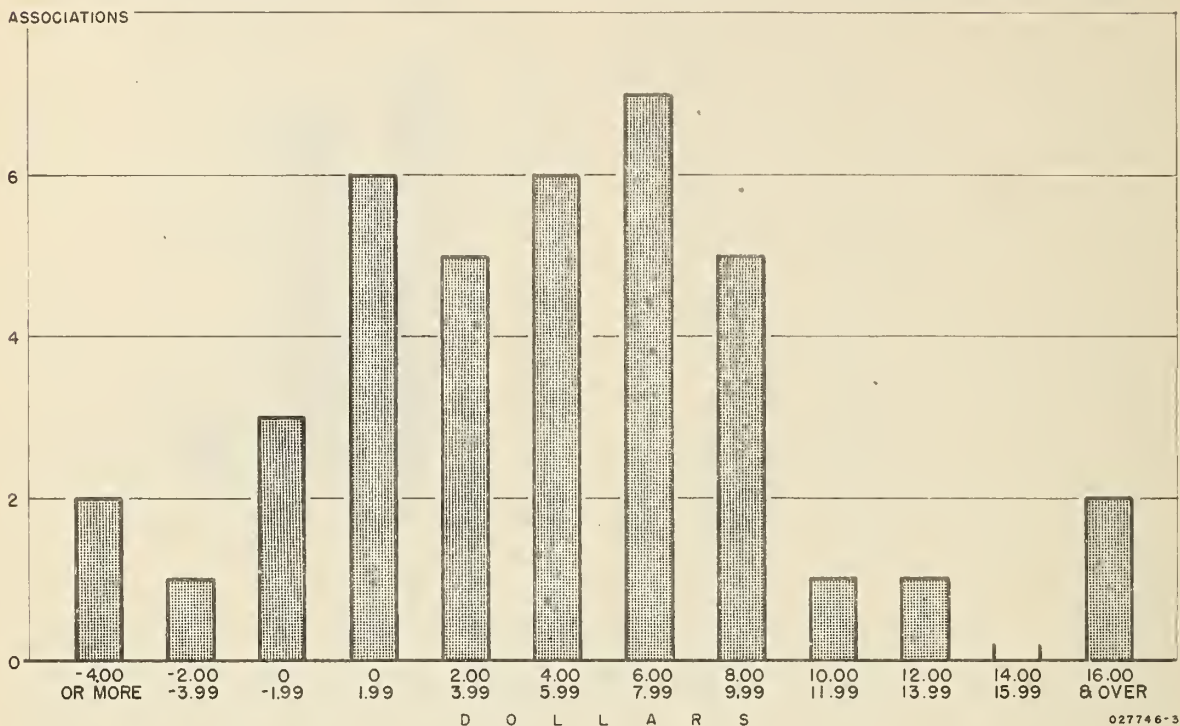


CHART 4

RECEIPTS, EXPENSES, AND NET SAVINGS PER LOCKER RENTED BEFORE INCOME TAXES AND INTEREST, 1947-48

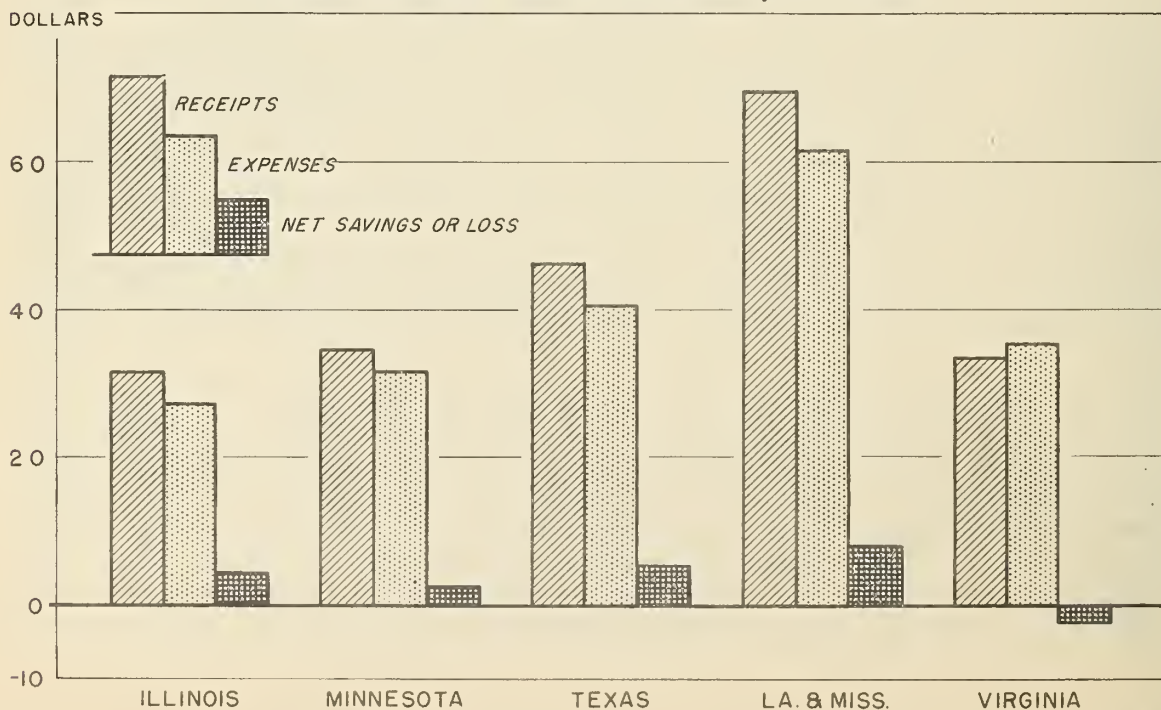


Table 28. - Percentage of associations¹ with indicated return on investment in fixed assets before payment of income taxes and interest, 1947-48.

PERCENTAGE RETURN ON INVESTMENT	PERCENT OF ASSOCIATIONS REPORTING
Loss-----	17
0-4.9-----	21
5.0-9.9-----	28
10.0-14.9-----	24
15.0 or over-----	10

¹29 associations furnished information on returns on investment in fixed assets.

just under 80 cents. Virginia had the highest cost at \$1.10 per dollar of processing income. Factors other than efficient utilization of labor that affect average costs are high labor rates, low processing rates, and low processing volume.

Numerous factors enter into determining savings in locker plants. Size of plant, gross receipts, investment, labor rates, efficiency of labor, ability of management, and many others play an important part in determining the level of savings. An analysis of some of the measurable factors in these 39 associations indicated in general that for plants with slaughter facilities to have the greatest chance for success they should have a capacity for not less than 500 lockers and preferably 700 or more, and that volume of business at current rates should be sufficient to provide \$35 or more gross receipts per locker. The analysis also showed that plants with an investment of more than \$75 per locker had considerable difficulty in realizing adequate net savings.

Some exceptions to these limitations were found. Through capable management; small plants, expensive plants, and low volume plants were operated successfully. These, however, were exceptions rather than the rule.

Table 29. - Labor and management cost per dollar of processing receipts, by States, 1947-48.

STATES	PLANTS SURVEYED	COST PER DOLLAR OF PROCESSING RECEIPTS
Illinois-----	24	\$0.99
Minnesota-----	9	.78
North Dakota-----	-	-
Texas and Oklahoma-----	14	1.07
Louisiana and Mississippi---	5	.79
Virginia-----	8	1.10
Total and average-----	60	.98

CONCLUSIONS AND SUGGESTIONS

Considering that frozen food locker cooperatives are relatively new, largely operated by inexperienced and untrained help, with many plants constructed during a period of sharply mounting costs both for materials and labor, the showing made by most of the associations studied is good. However, as in any new and rapidly expanding industry, there are certain weaknesses and leaks that come to light which need improvement.

Slaughter facilities of several plants, when compared with volume handled, were larger and more costly than needed. Unless an association operates a large plant or is set up to slaughter for a number of branch plants, or does substantial custom killing for other than locker patrons, slaughter facilities need not be large or expensive. Very few plants surveyed were justified in using dehairing machines on the basis of their annual slaughter.

Slaughter facilities frequently were too large in proportion to chilling and curing capacity. Lack of chilling capacity acts as a bottleneck in slaughtering. More consideration needs to be given to adjusting slaughtering capacity to chilling, aging, and curing space.

A plant chilling carcasses within 24 hours after slaughter should provide 12 to 15 inches of usable track space for each hog, calf, or lamb, and 18 to 24 inches for each beef carcass in the chill room. For the same weekly volume, the greater the number of days of slaughtering, the smaller may be the chill room. For example, to slaughter 2 days a week will require only one-half as much chill space as where the same weekly volume is slaughtered in one day. Additional space should be provided for aging beef depending upon the number of days carcasses are held in the age room.

Many plants provided slaughter service on 4 to 5 days each week when the volume slaughtered could easily have been handled in 1 or 2 days. By limiting service to certain days of the week this volume could be handled at reduced cost. However, more frequent slaughter may be necessary in some plants due to limited chill room space.

Due largely to limited volume, the returns from slaughtering services in several plants were too small to make it a profitable operation. To operate a slaughter plant successfully a locker association must have sufficient volume to justify additional expenditure for facilities and labor. While it was not possible to obtain accurate data on slaughter plant operating costs it is believed that an equivalent volume of at least 300 cattle and 1,000 hogs per year is necessary to profitably operate a small slaughter plant.

Fast moving electric hoists attached to an overhead I-beam give a high degree of flexibility by serving all areas of the slaughter room. They also lighten labor and speed up operations.

Walls and floors in slaughter rooms should be constructed of durable materials which can be easily washed. Most commonly used material is cement for floors and tile, tile-faced brick or cement for walls.

Livestock pens in some plants had dirt floors, and very few were equipped with adequate drains. In order to prevent undesirable odors and contamination, these pens should be cleaned and flushed after each day's use. This is especially true of plants located in or near town limits.

A number of plants studied did not have an adequate supply of either cold water for washing and cooling carcasses, or hot water and steam to scald hogs and poultry and to maintain the plant in a sanitary condition. An ample supply of pure water is essential to good slaughter operations. In some plants where city water temperatures are too high in summer or where water rates are high, it may be desirable to dig a well. The use of water cooling towers conserves water and reduces costs.

A number of plants experienced difficulty in heating their scalding vats due to lack of a steam boiler. Some plants had to start heating water in the scalding vat the night before. A small boiler is an essential piece of equipment in a slaughter plant, not only to provide steam for heating water, but also to help keep the plant in sanitary condition.

A number of plants were not equipped with blood traps in drains to prevent blood from entering sewers. Such a practice not only is wasteful but it may entail costly repairs due to stopping up drains and sewage disposal systems if continued over any period of time. Some cities and towns prohibit running blood into sewers and no doubt others will do so if trouble occurs. Where volume is not large and blood is run into a city sewer it should be diluted with plenty of water. If run into a septic tank oversize sewage disposal facilities are necessary. Adequate drains to remove water rapidly during slaughtering operations and to clean up slaughter rooms, and a satisfactory sewage disposal system are essential in operating a sanitary plant.

Numerous plants were equipped with seven to eight foot rails in slaughter, chill, and age rooms allowing beef carcasses to drag on the floor if not quartered for hanging. The use of at least ten foot rails is desirable as they permit hanging whole carcasses, require less space in chill room, and maintain better conformation for conventional cutting and processing.

A separate lard rendering room improves sanitation as well as quality of product by preventing contamination from odors resulting from slaughtering.

Keeping quality of pork deteriorates rapidly unless frozen or cured soon after the animal heat is removed. A number of plants held pork too long in the chill room prior to cutting and curing. Some plants also maintained temperature too high in chill rooms to remove animal heat rapidly. A maximum of 3 and preferably 2 days at 34 to 36 degrees temperature is recommended.

There was too much variation and lack of standardization in curing and smoking time and temperatures which often resulted in unevenness in quality and condition of the cured products. Very few plants were equipped with automatic controls on smokehouses to regulate temperatures. If uniform high quality cured products are to be manufactured and loss and shrinkage are to be prevented such controls are essential. The use of steam coils, particularly in larger type smokehouses, plus a smoke producing generator located outside the smokehouse reduces fire hazards, and makes it possible to maintain more uniform temperatures throughout the smoking period and thus produce higher quality products.

The use of low wheeled meat trucks for washing and soaking, as well as for salting meat to be cured and for mixing sausage is a means of reducing rehandling and lowering labor cost.

Much valuable research work has been done on curing and smoking methods by State colleges, as well as by manufacturers of curing materials. Careful attention to practices recommended by these agencies should result in less spoilage and produce more uniform and higher quality products.

To reduce excess humidity in chill and age rooms, blower type coils are often used although under proper operation of refrigerating equipment and temperature in these rooms pipe coils should give satisfactory results. Some operators reported the use of ultra-violet lamps to reduce slimy conditions on carcasses and eliminate odors, although where these rooms are kept clean and proper uniform temperatures and humidity are maintained this type of equipment is not necessary.

Adequate draining by means of troughs from curing bins into properly placed receptacles or to drains, plus the use of blowers in curing rooms, tend to reduce excess moisture and retard mold growth. In some plants, a change in the pitch of the floor is needed to provide proper drainage.

Thoroughly cleaning curing bins, shelves, walls, and floors of curing rooms either by steam or hot water is another means of keeping down mold. This can be done during summer months when cured volume is lowest. Removing curing bin shelves and cleaning them outdoors in sunlight also helps. A few plants provided types of bins which can be "knocked down" and taken apart easily for cleaning and drying outside the curing room. Several operators reported that the use of "ultra-violet" lamps tended to retard the growth of mold in the curing room.

The practice of allowing patrons to leave cured meat in curing room for long periods, particularly prevalent in Southern plants, should be discouraged because it accentuates the problem of reducing mold and spoilage. Several plants where patrons do not want to store cured meat in lockers provide a separate cured meat storage room, where meat is either hung or stored in bins. This is a dry refrigerated room kept at

temperatures of 45° to 50°. A moderate charge, based on poundage and time stored, is made for this additional service. Where cured meat is held for relatively long periods, some plants wash off mold in order to keep it from penetrating the meat.

Thorough daily washing and cleaning of processing room floors, tables, walls, and equipment, the use of disinfectants and insecticides, and the use of clean aprons by employees engaged in processing operations not only assures the production of healthful food but builds up confidence on the part of patrons in the association's operations.

Lack of attention to small details, such as the failure to accurately weigh curing mixtures, to use percentage scales in pumping pickle, or to maintain proper and uniform temperatures for pickle and meat to be cured, often causes poorly cured meats and results in dissatisfied patrons. Carelessness in placing food in the wrong locker destroys not only a patron's confidence but often results in costly adjustments by the plant.

To eliminate the possibility of mixups one operator follows the policy of forbidding the use of a master key by employees opening lockers. Each patron's key is attached by means of a clip to the freezing tray when his food is placed in the sharp freezer. Then when taken out of the freezer there is no chance of it being placed in the wrong locker box.

Untidy appearance of employees in processing rooms and a lack of courtesy shown patrons were other weaknesses observed at a few plants. Attention to these as well as other details are necessary if a plant is to provide "top notch" service and operate successfully. To correct such weaknesses calls for proper training and constant supervision of employees by the management.

More thought needs to be given to better utilization and merchandising of both edible and inedible by-products which are among the most profitable sources of income to commercial packers. While it is difficult for a small individual plant to make effective use of these products with present types of equipment, larger plants or a group of plants in a limited area by going together might obtain sizable earnings from their proper processing and merchandising by providing central facilities. Research is needed to develop more efficient, small type, equipment for processing both edible and inedible by-products.

Increased income from the sale of hides might be realized if more care were taken to prevent cutting and scoring during removal. Proper curing also assures greater revenue.

While most plants did a small amount of poultry dressing and processing, largely for locker patrons, only a few were doing any custom work or processing poultry for sale. In many communities poultry operations could be materially expanded without much additional cost in either equipment or labor. In most areas, the heavy months of poultry supply

come during the summer and early fall, at a time when livestock processing volume is the lowest and labor is not being used to capacity. Additional receipts from poultry dressing and processing should help to increase revenue during this period. By providing processing and storage services during periods of temporary local poultry surpluses the locker plant might help to stabilize prices in some areas.

A number of plants surveyed were making little effort to expand their processing service to serve owners of home units. The sale and use of home frozen food cabinets is expanding and promises to continue. The progressive locker plant operator should use every means possible to encourage the use of service provided by the locker plant, as well as the sale of meat and other frozen food products to these home unit patrons. With a proper educational and promotional program, much additional revenue can be obtained from home unit users.

In a number of plants surveyed, particularly those located in remodelled buildings, processing rooms were long and narrow, or were too small, or were poorly laid out for most efficient use of labor.

In general, the most efficient utilization of space in processing rooms is found in a nearly square room. The breaking, trimming, cutting, grinding, and wrapping operations should be so arranged that the product flows through the room with as little back-tracking as possible. One of the best type of lay-outs is a U-shaped arrangement. Carcasses come from the chill room and meat travels around the U enroute to the sharp freezer. The equipment is so arranged that employees can work from either inside or outside the U.

Inasmuch as nearly half the total expense of operating a locker plant is labor and nearly all the workers' time is spent in processing, it is highly important that careful consideration be given to design and arrangement of the processing room. A poorly arranged room can be wasteful of the workers' time as well as lead to confusion and errors in processing.

Waiting rooms and lobbies in a few plants were too small for patrons' convenience. Even in plants with larger lobbies, too little attention was given to making them attractive. Little or no use was made of advertising the locker services or providing the sale of either the plant's own products or commercially frozen foods. In several instances lobbies were used for storing boxes, paper, and other supplies.

The outside appearance of several plants, where yards had grown up to weeds and trash was scattered around, needed attention. A number of plants, however, were very attractive with flowers, shrubs, and well-kept lawns. A few buildings need painting. Clean, attractive yards and buildings add much to the appearance of a plant and attract and hold customers' patronage.

In a number of plants visited there appeared to be an attitude on the part of the management of just waiting for business to come in rather than an aggressive one of promoting and increasing the association's volume. Some of this may have been due to the low wages paid managers, failure to delegate proper authority to managers, and the lack of vision on the part of directors. A more aggressive and intelligent educational and promotional program is needed in many associations. Patrons need more information on the value of locker plant services as well as how they can best get the most value out of them.

As a result of poor arrangement some plants made inefficient use of labor and had high operating cost. Well laid out plants, in which the flow of product moves smoothly without back-tracking, increases labor efficiency and lowers operating costs.

The wide range in receipts, expenses, and net savings shown by different associations emphasizes the need on the part of most plants for improved use of labor and equipment, more efficient processing, increased volume, additional services, greater returns from by-products, reduced costs, and a more effective job of merchandising goods and services. If locker cooperatives will direct their efforts toward improving their operations along these lines, they can become an important factor in reducing distribution costs and thus benefit both producers and consumers.

Too many associations fail to keep adequate accounting records essential to proper management. More attention needs to be given to keeping records of slaughter and processing volume; income from different services; and a breakdown of major costs for labor, supplies, depreciation, utilities, etc. Detailed spot checks of slaughtering, cutting, wrapping, curing, smoking, and lard rendering receipts and expenses are needed to find out where leaks in operations are taking place. A closer check of individual locker patrons volume and amounts spent for processing also is needed in order to find nonprofitable accounts and be in a position to improve them.

While locker cooperatives operate in a field of relatively narrow margins, they have an excellent chance to improve quality, up-grade diets of both farm and urban patrons, expand outlets for locally produced food, and narrow the spread between producers and consumers.

The possibilities for future expansion in the marketing, processing, storing, and merchandising of locally produced food as well as distributing commercially frozen food, produced outside the area, are promising provided managers and directors have the vision and ability to seize and capitalize upon the opportunities presented.

APPENDIX

LOCKER PLANT SLAUGHTER FACILITIES

Many types and sizes of abattoirs are operated by locker cooperatives. It was found that the plants ranged from small slaughter rooms with simple equipment to large abattoirs equipped for slaughtering and dressing comparable to small meat packing establishments. The study indicates that frequently abattoirs were located some distance from the locker plant while in other instances they were attached to the locker plants. Those abattoirs located apart from the locker plant often provide slaughter service only. The chilling, aging, and other processing service including curing, smoking, and lard rendering are performed in the locker plant or plants of the association. In other instances, where several locker plants are operated by a cooperative, one or all of the processing services are provided at the central slaughter-processing plant.

The study failed to indicate any type of abattoir which could be recommended for any particular area or section. Some small plants, very efficient in performance and operating results, made a better showing than some larger plants. The larger abattoirs seemed to do a better job in areas where cooperative associations operate a number of locker plants close together. Of the larger facilities included in the study, few had been in operation for a long enough time to determine their degree of efficiency.

Plants having the larger slaughter facilities are able to handle their by-products more efficiently than the smaller ones which had less equipment and smaller volume. Larger equipment tended toward efficient use of labor.

The smaller abattoirs, with a small slaughter volume, are unable to justify more elaborate equipment and most of the dressing job must be done by hand.

Where slaughter facilities are separated from locker plants the transportation of carcasses entails more expense than where they can be moved by overhead rails into the adjoining locker plant.

No particular type of slaughtering facilities was found in any section of the United States. However, it was found that most plants in the Middle West had more power machinery than those in the other areas. One reason for this may be the high production of hogs in the area served by these plants. Most of the machinery in slaughter rooms is used to dress hogs and many plants surveyed are located in areas where hog production is relatively low, so little mechanized slaughter equipment was justified.

The slaughter facilities may serve anywhere from one small locker plant to a half dozen or more with several thousand lockers. Where one

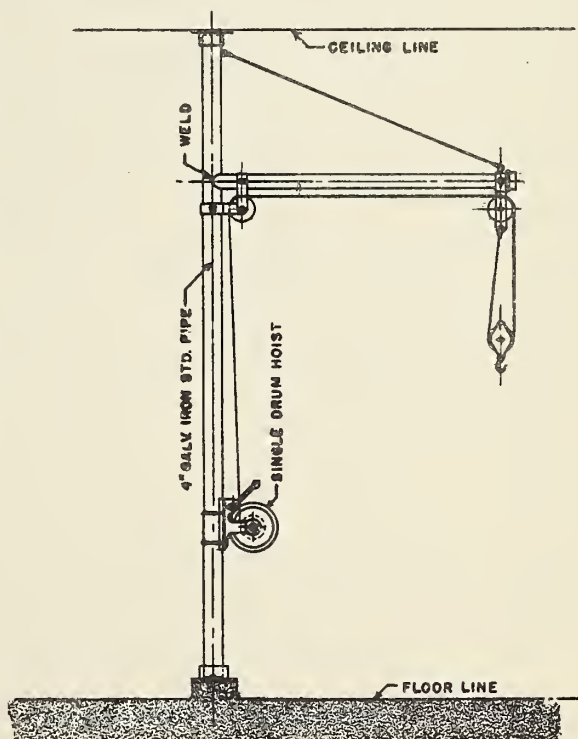
slaughter plant serves several locker plants it is usually centrally located and carcasses are trucked out to the branch plants for processing. In a few instances slaughtering as well as processing is performed at the central plant. It was found that buildings were constructed of practically all available building materials. Most plants were constructed of brick or cinder block, or a combination of these materials.

The location of the slaughter facility in relation to the community in which it is located depended in large measure upon local town ordinances and regulations. Over half of the plants studied were located within the corporate limits of the city or town. Those plants placed beyond corporate limits had higher initial costs because it was necessary to furnish wells for their water supply and a separate sewage disposal system. These two services are usually rendered by the municipality when plants are constructed within the corporate limits. Plants located in areas beyond the city or town limits often pay higher insurance rates because they do not enjoy the same degree of fire protection. The slaughter plant located outside of a city or town limits is usually in a better position to provide inedible rendering facilities, and can usually provide more parking space for patrons. Land costs also are lower.

Most of the slaughter plants were equipped with electric hoists to aid in raising and lowering animals during slaughter, although several plants used hand hoists of various types. In almost all plants the electric hoists are mounted on an I-beam attached to the ceiling. This makes the hoist movable from one point to another. Some plants use two hoists in their slaughter rooms, one over the hog dressing area and the other over the cattle dressing area. A few plants studied were equipped with an I-beam forming a U-curve so that one hoist could be used to serve both dressing areas.

For small plants where volume does not justify the investment in a movable electric hoist, the type of radial hand hoist shown appeared to be superior to the conventional stationary type in general use.

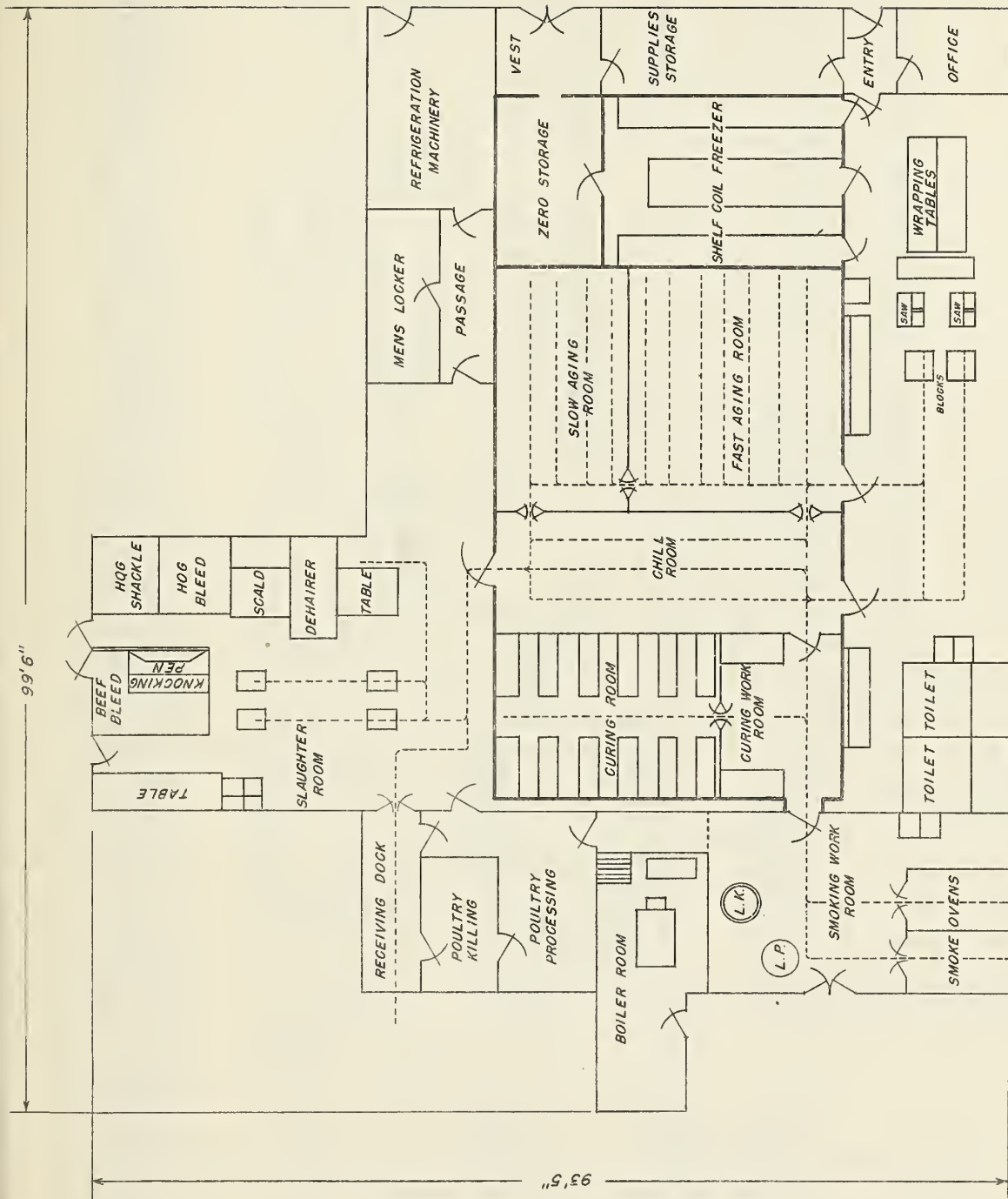
Plants skinning hogs require less floor space and less equipment than those scalding and scraping to clean the carcasses. Although skinning produces a carcass of less desirable appearance,



especially where slaughtered for retail outlets, much smaller investment in machinery and equipment and less labor are required. Also some operators claim quicker curing and better smoke penetration for cured products and the production of whiter lard.

Some plants are constructed with covered and enclosed livestock pens. These are highly desirable where plants are located within the corporate limits of a city or town because undesirable odors are held to a minimum. Also in cold climates livestock delivered to the plant for slaughter are held in a warm place until slaughtered.

The following plant layouts illustrate a number of different types of slaughter facilities observed in the survey.



025338-13

Figure 1. - This central processing plant is located in the Middle West, outside the town limits. It provides complete slaughtering, processing, and freezing of livestock and poultry for five branch locker plants with 3,400 lockers. The slaughter room is highly mechanized with a power equipped hog line similar to commercial packing plants. Water supply is furnished by a well and an artificial pond; sewage disposal is through a septic tank. The plant of brick and concrete at a cost of approximately \$100,000. This type of plant, if properly managed and with adequate volume, should operate efficiently.

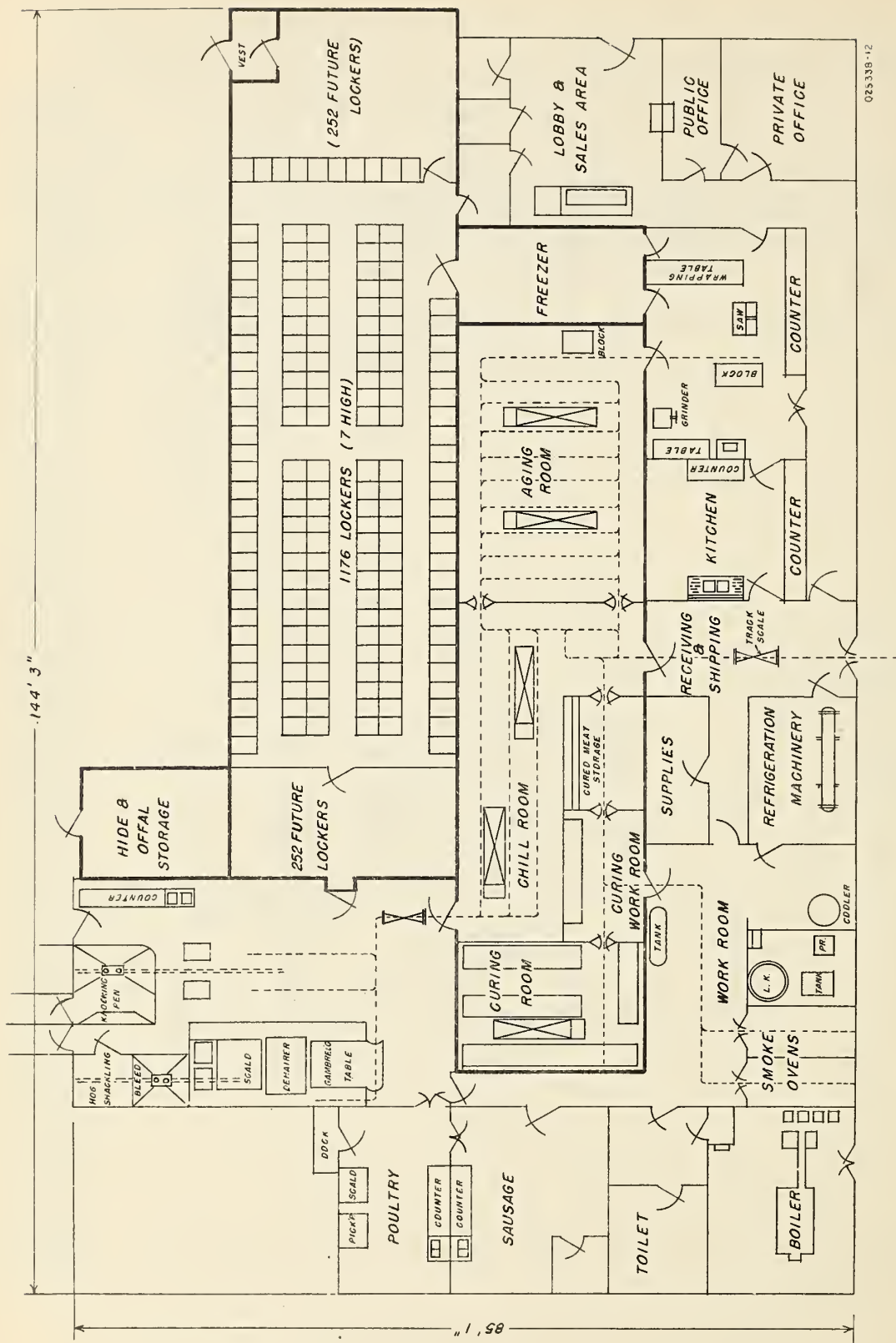
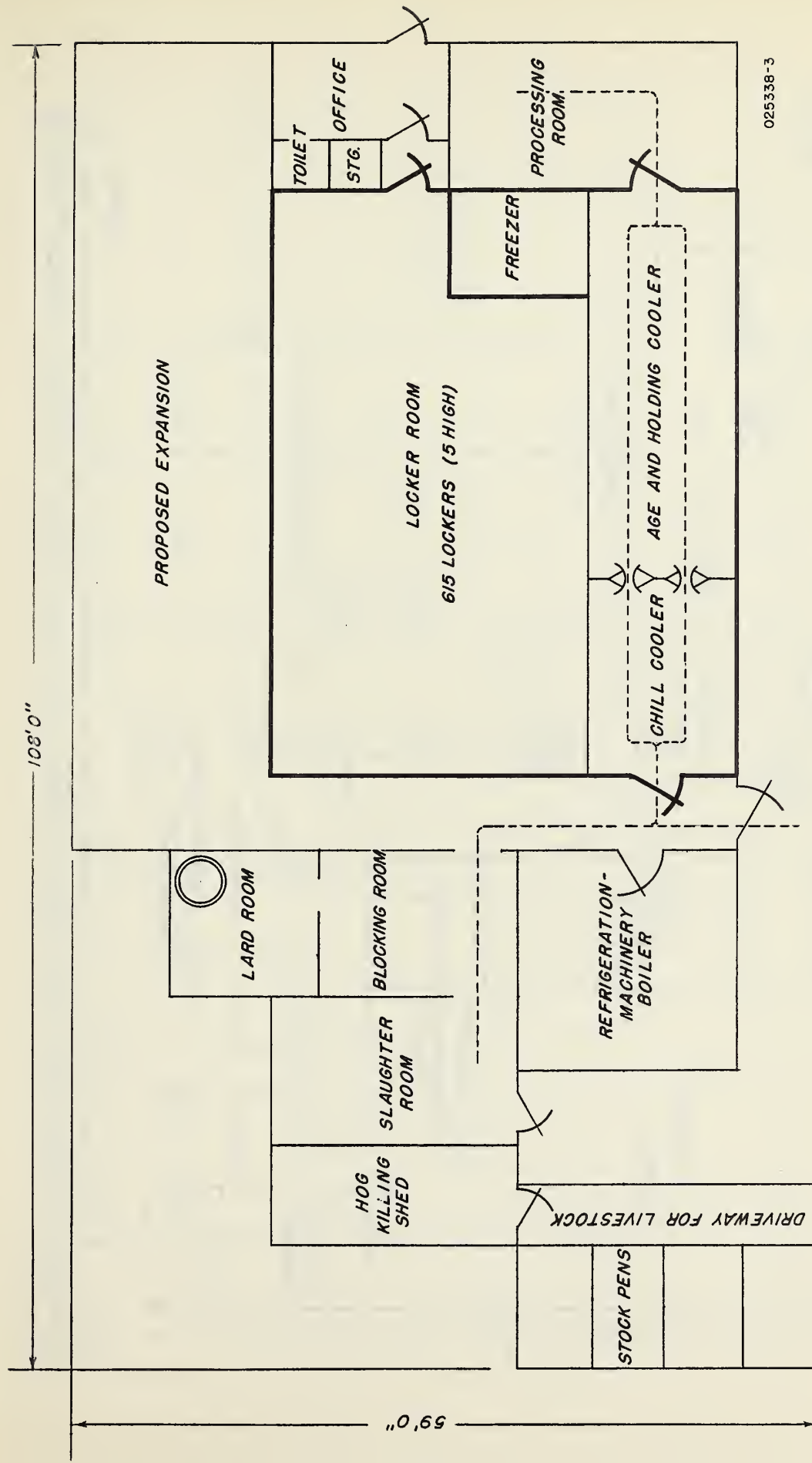


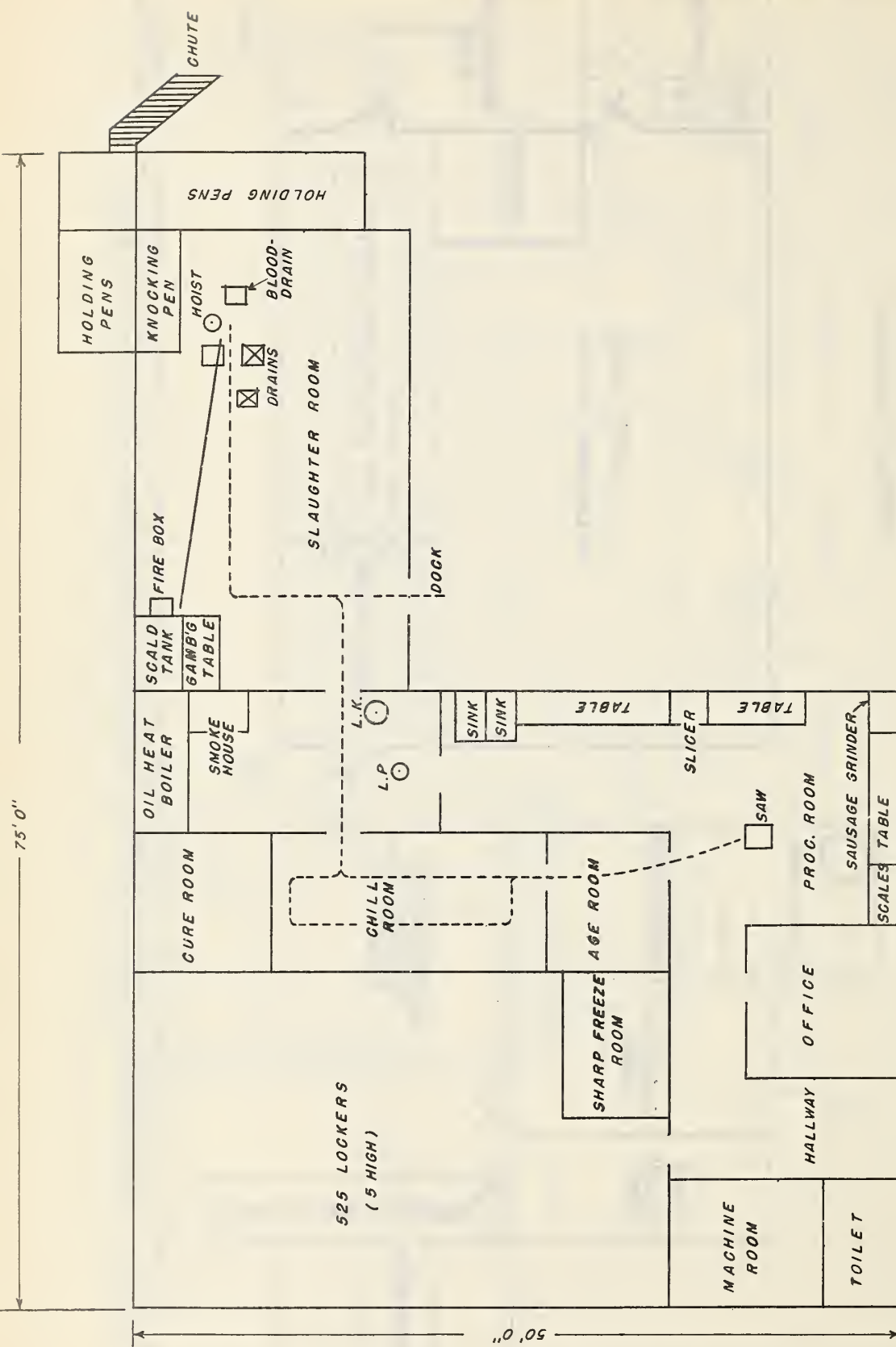
Figure 2. - A complete slaughtering, processing and locker plant is located in a Middle Western town. It has 1,176 lockers installed and a capacity of 1,700. The slaughter room, equipped with a mechanized hog line, has a power driven debailer. A separate area provided for poultry dressing and a refrigerated hide and offal storage aid in improving sanitation. The plant slaughters and sells meat to stores and restaurants. Sausage is also manufactured for sale to retail outlets in the area water and sewage disposal provided by the municipality. Building constructed in 1947 of brick and frame cost about \$175,000.

This plant will need substantial outside processing volume to operate efficiently.



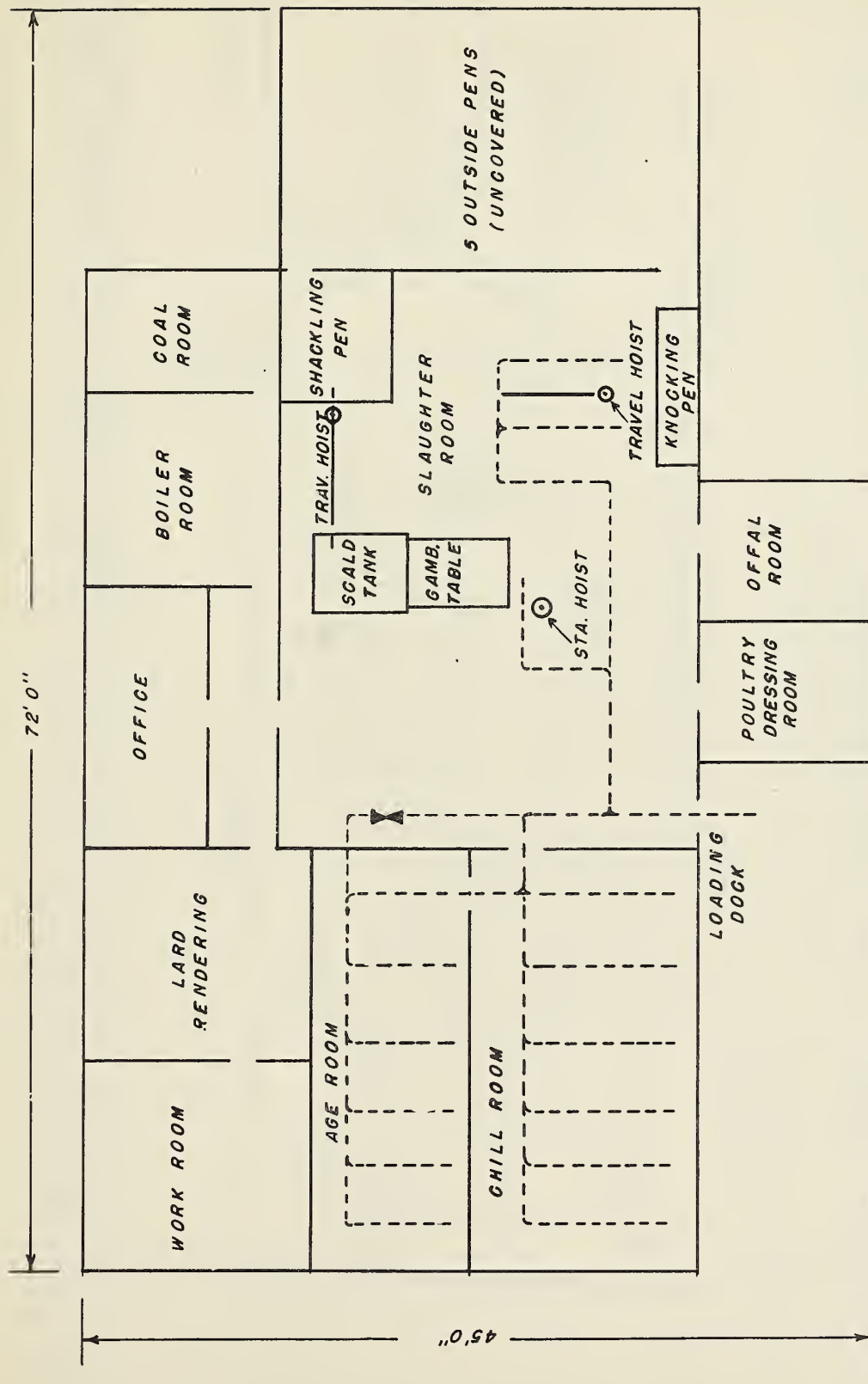
025338-3

Figure 3. - This abattoir and locker plant, located in the Middle West, has slaughter facilities for 615 lockers. All equipment in the slaughter room is hand operated. The refrigerated area is too small to handle the slaughter volume properly. The plant, located a short distance outside the corporate limits, uses municipal water. Sewage disposal is through a septic tank. The slaughter room and equipment, built in 1941, cost \$2,500.



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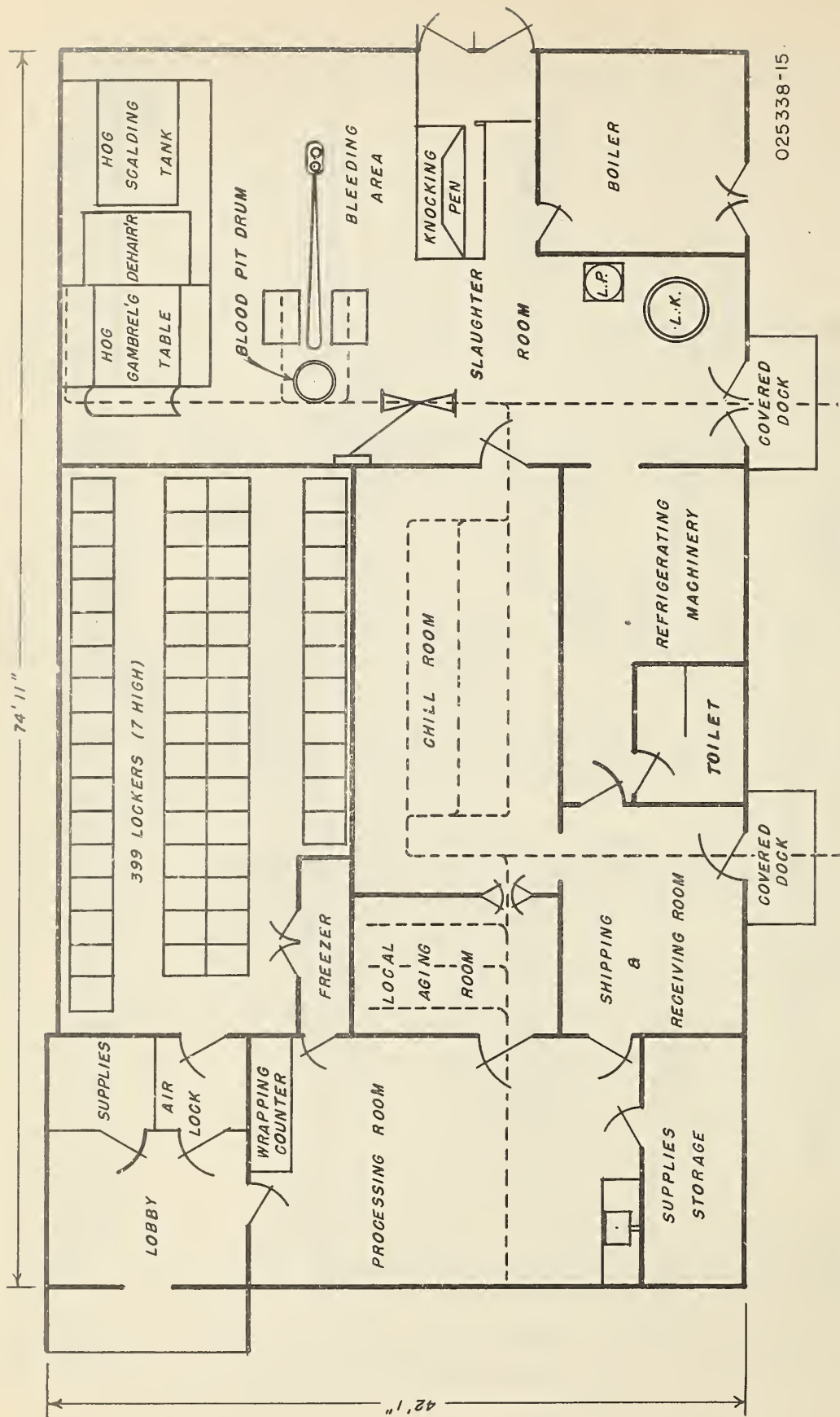
Figure 4. - An abattoir and locker plant located in the Middle West just outside city limits. The slaughter room serves this locker plant and one branch - a total of 830 lockers. Slaughtering equipment is mostly hand operated. Water supply and sewage disposal facilities are provided by the municipality. Slaughter room and equipment, added in 1943, cost \$2,500. This plant has inadequate chilling and aging space.



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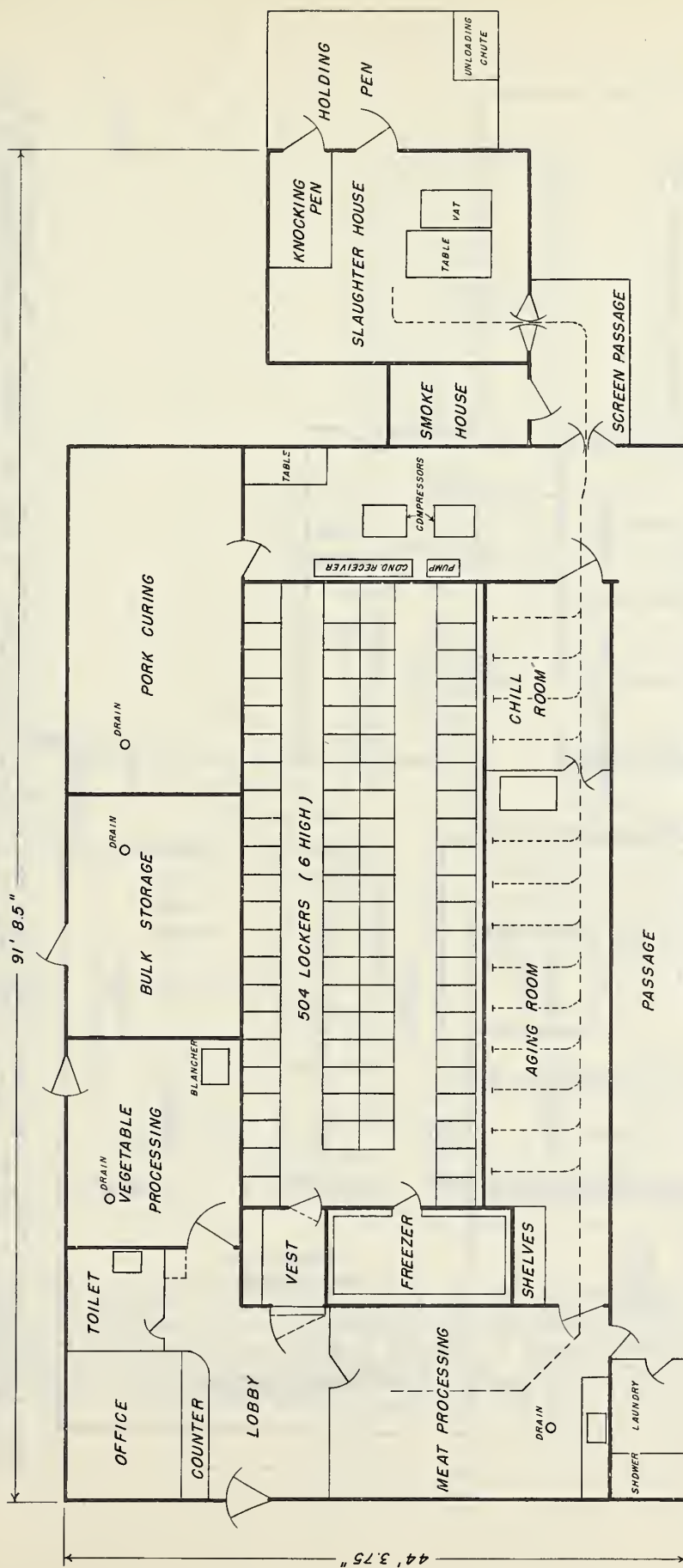
Figure 5. - This abattoir in the Middle West, located outside the corporate limits, slaughters for one locker plant which has 1,000 lockers. Animals are slaughtered, carcasses chilled, and then hauled by truck to the locker plant for processing. The water is supplied from a privately owned well and sewage disposal is through a septic tank. The building of concrete block was constructed in 1946 at a cost of \$25,000.

This is compact, well designed layout and the plant has the capacity for slaughtering more than its locker plant requirements. One disadvantage is that pork fat must be returned to the slaughter plant for rendering.



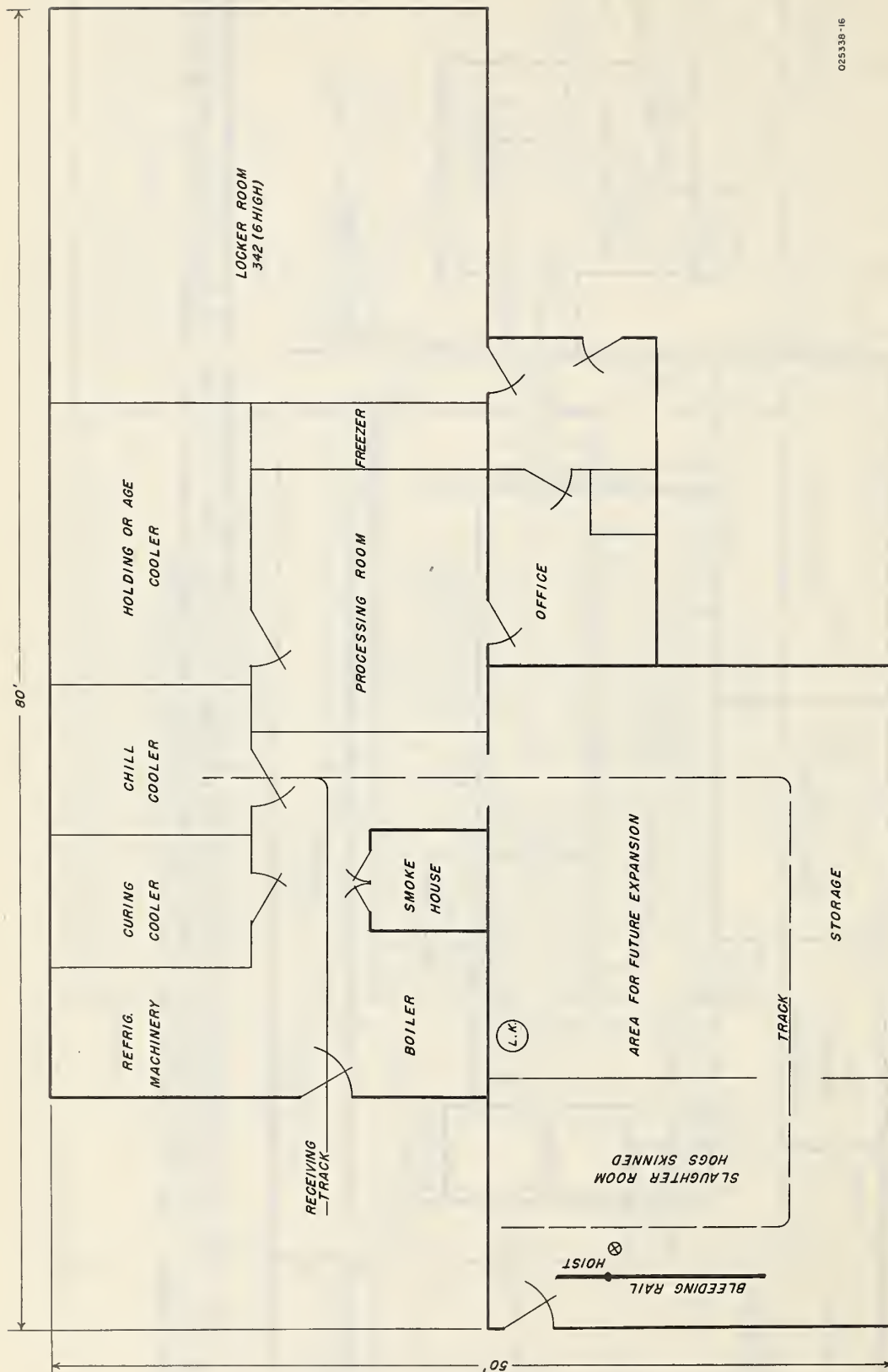
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Figure 6. - A combination abattoir and locker plant in the Middle West located outside the town limits. The slaughter room provides slaughtering services for two other branch locker plants which have a total of 1,900 lockers. This plant processes only for patrons living in the immediate area as other processing is provided at one of the branch plants. A mechanical hog dehairer is to be installed in the slaughtering room. Water is supplied from a private well and sewage disposed of through a septic tank. The building is of concrete block construction. The plant was erected in 1947 at a cost of about \$35,000.



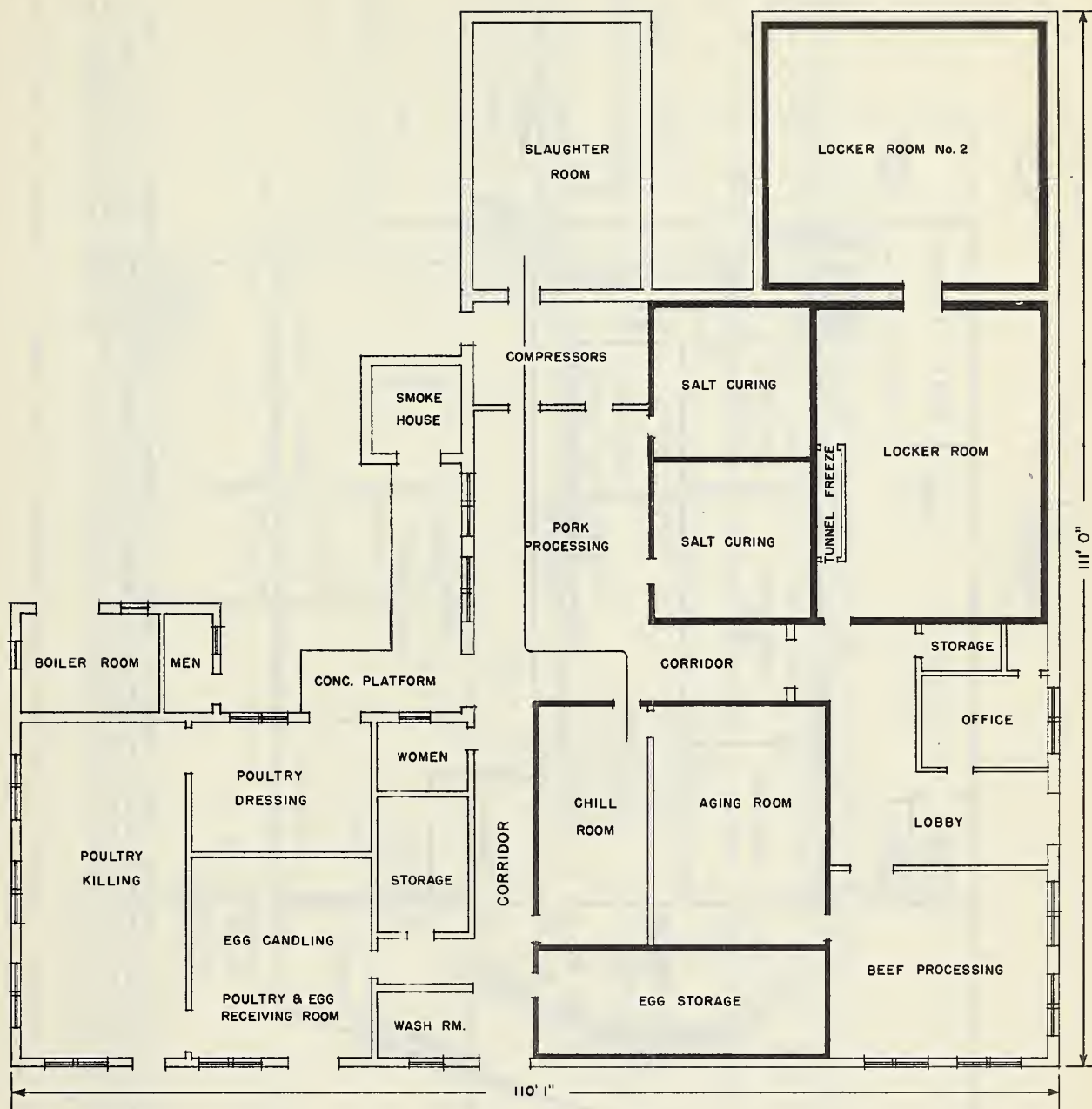
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Figure 7. - This locker plant, with an attached slaughter room, is located in the South West. The slaughter room is relatively small but provides sufficient area for slaughtering operations for 504 lockers in the plant and a few retail stores in the town. The water supply is furnished by the town and sewage disposal is through a septic tank. Plants of this type are more expensive to construct due to passage way extending from the processing area to the slaughter room. The plant of brick construction built in 1945 cost \$35,000.



025338-16

Figure 8. - An abattoir and locker plant in the Middle West located within the corporate limits of the town. The slaughter room provides slaughtering for the 342 lockers in the plant and a few home storage units. As hogs are skinned, the only equipment in the slaughter room is a movable hoist mounted on an I-beam. Both water and sewage disposal is provided by the municipality. Refrigerated rooms for chilling and holding carcasses are too small to properly handle the volume during peak slaughter periods. The plant was constructed in 1945 at a cost of \$26,000.



027541-2

Figure 9. - This abattoir and locker plant is in the South and is located within the corporate limits of a town. The slaughter room handles slaughtering for 1,000 lockers, and a few retail stores and restaurants in the town. All the equipment in the slaughter room is hand operated. It uses the municipal water supply and sewage disposal systems. An unusual feature is the space provided for handling and storing eggs as well as poultry processing. Too much valuable space has been lost in the extra wide halls. Refrigerated areas separated by hallways have increased both building and operation costs. The plant was constructed in 1947 at a cost of \$125,000.

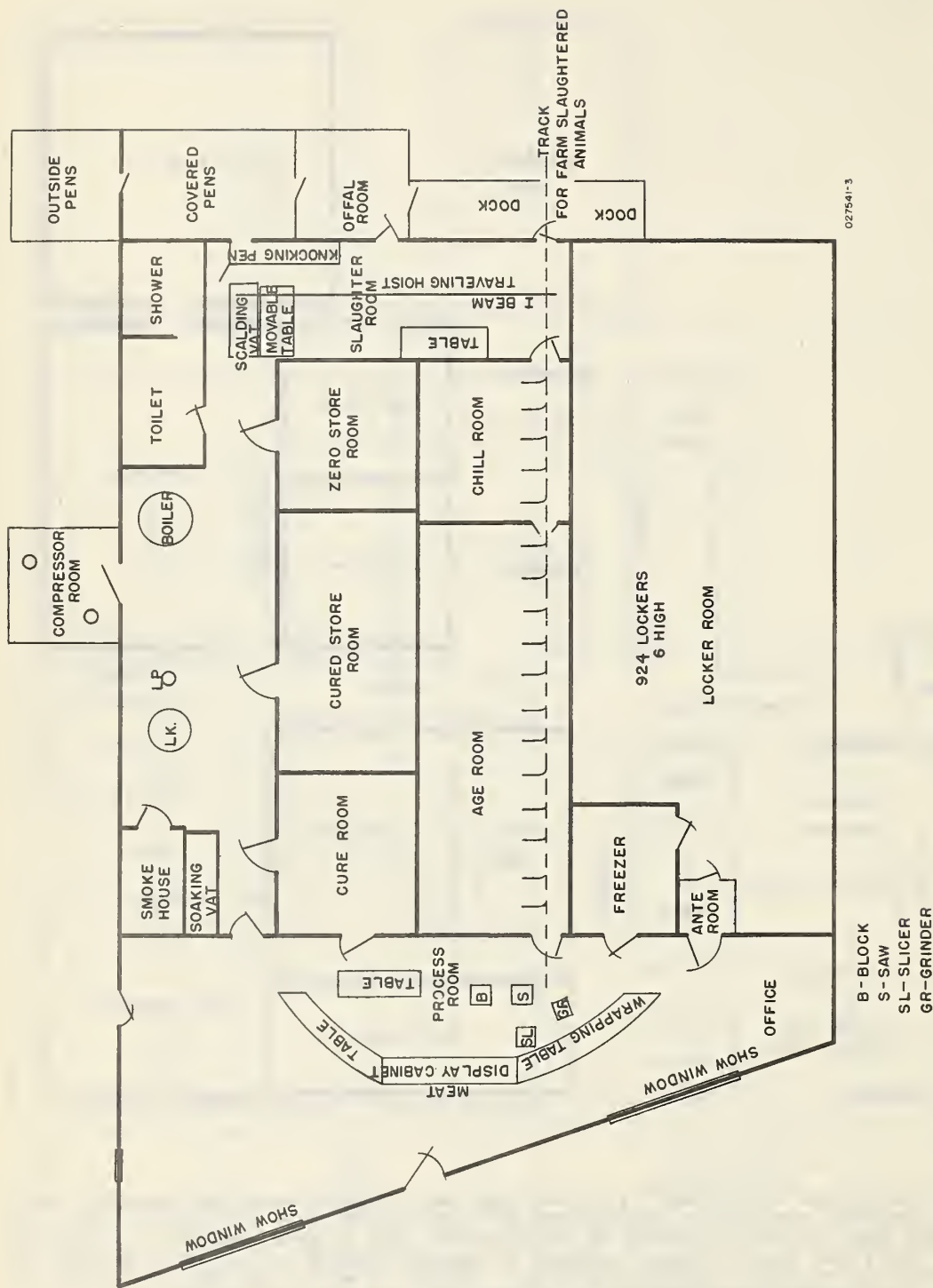


Figure 10. - A farmers' locker and slaughter plant located in a medium size Southwestern city. The slaughter room is a small, rectangular room using mostly hand equipment with a traveling hoist mounted on an I-beam extending the length of the room. It slaughters for 924 lockers, its own retail meat market, and several outlets in the city. Its outstanding feature is a retail market selling meats and groceries. Both water and sewage disposal are supplied by the city. The plant was constructed of concrete block in 1944 at a cost of \$58,000.

In spite of small and inexpensive slaughter facility this plant slaughtered a large volume of livestock, not only for its patrons but for other outlets.

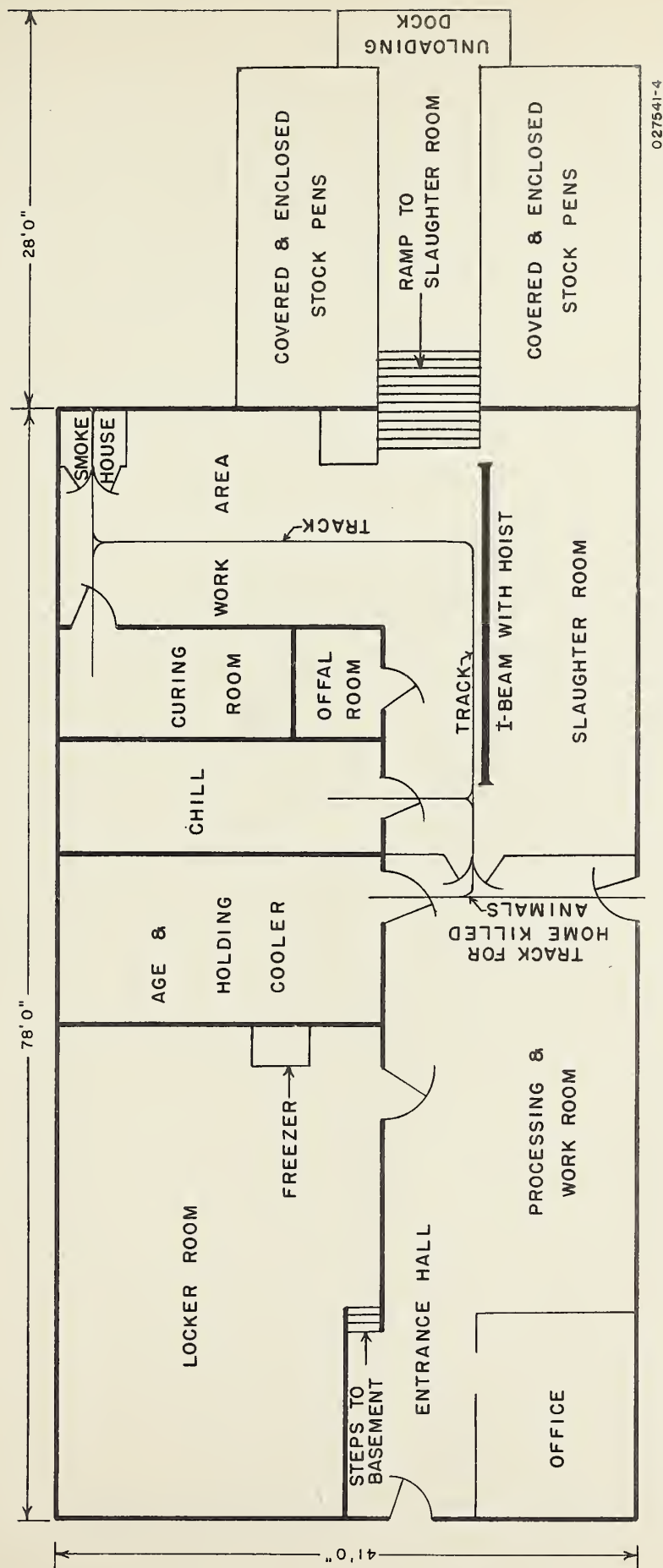


Figure 11. - This slaughter and locker plant, located in the Northern Plains area, provides service for 567 lockers. It is one of several plants included in this study providing livestock pens as a part of the main building. It uses municipal water and sewage disposal facilities. Hogs are skinned rather than scalded which accounts for the small amount of equipment in the slaughter room. The plant has a basement which provides room for further expansion if needed. The brick and concrete building was constructed in 1945 at a cost of approximately \$57,000 equipped.



